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Tighten Rail Joints

STOP end batter

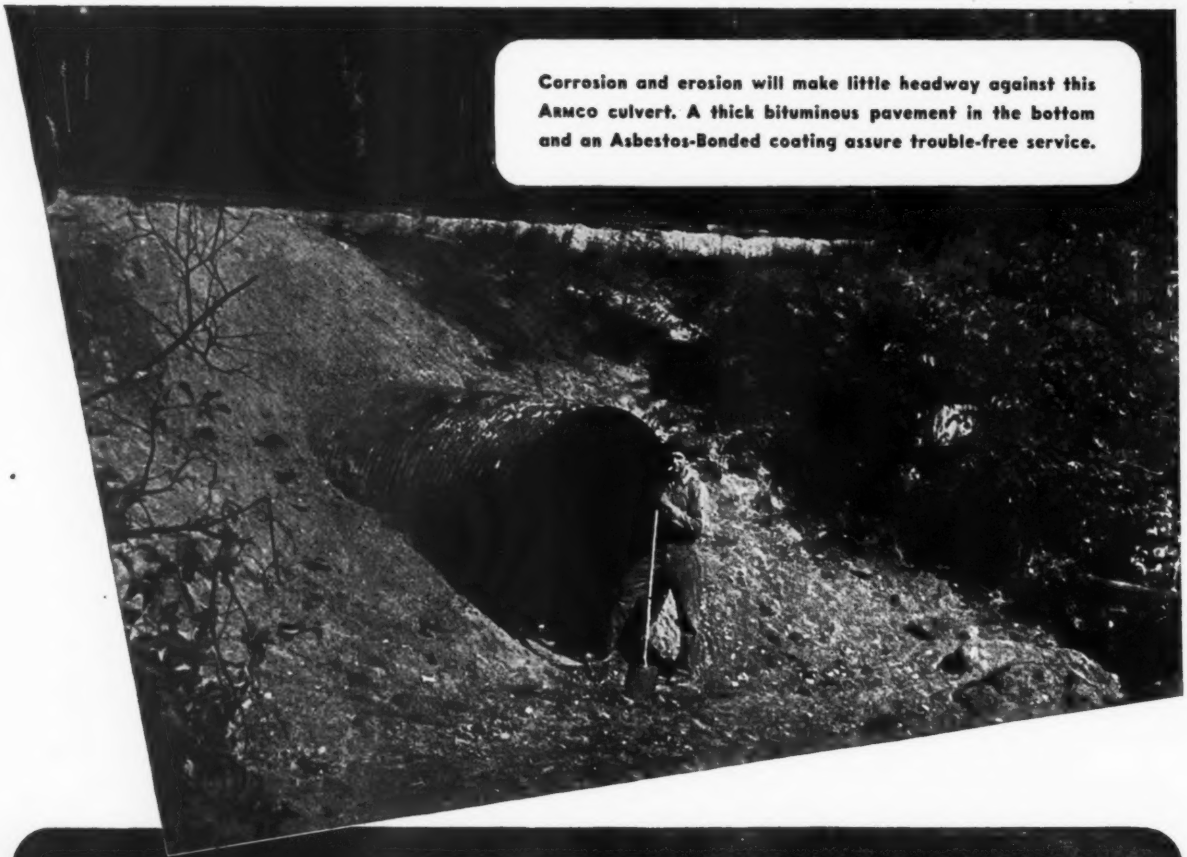
with Bethlehem Track Fastenings

You can pull track bolts up really tight and put an end to end-batter of rails when you use Bethlehem Heat-Treated Bolts and Hot-Forged Nuts. There's no danger of stripping the threads. You'll find that you reduce impact and pound at the rail joints.

Strength and tenacity for the hardest rail joint service is found in Bethlehem Heat-Treated Bolts and Hot-Forged Nuts. They hold the rails to rigid, accurate alignment. The rail joint assembly is held tight; low joints are kept at a minimum and maintenance costs are materially reduced.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY



How Asbestos Fibres Prolong Culvert Life!

• Now corrosion and erosion, the cause of many culvert failures, have been stopped in their tracks. ARMCO engineers solved the problem by using a layer of asbestos felt to permanently bind a protective bituminous coating and pavement to the pipe. When you use Asbestos-Bonded Corrugated Pipe your culverts last longer and cost less to maintain. This is the reason:

A layer of asbestos felt is firmly applied to the ARMCO Ingot Iron base metal as it emerges from the galvanizing rolls. Thus millions of asbestos fibres become partly embedded in the zinc as it hardens. When the full bituminous coating is applied it in turn is mechanically bonded to the pipe by means of the asbestos fibres.

This tough bituminous coating assures complete and lasting protection against corrosion. And a thick pavement of the same material safeguards the bottom from erosion.

Protect your investment and make maintenance dollars go farther by specifying Asbestos-Bonded ARMCO Paved Pipe for that next drainage job. Write for prices. Armco Railroad Sales Co. Inc., 1931 Curtis St., Middletown, Ohio.

Asbestos-Bonded ARMCO ARMCO PAVED PIPE

FAIRMONT LEADS IN FEATURES THAT SERVE YOU BEST

SPECIFY THE Fairmont M9 SERIES "D" CAR

for Easier and Faster

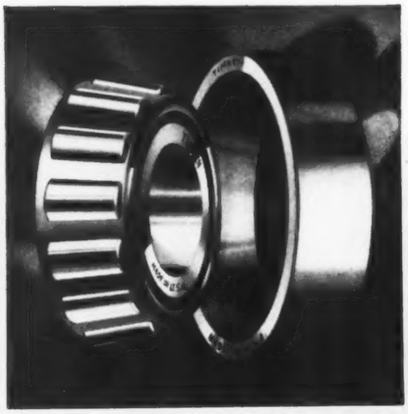
INSPECTION TRIPS

With its Fairmont Hy-Load 5 to 8 H. P. roller bearing engine, endless cord belt drive and sturdy but light weight construction, the Fairmont M9 Series D car saves more than time in inspection service. Its efficient power plant gets maximum mileage from every gallon of fuel. Its longer wearing roller type crankshaft bearings minimize repairs; ready accessibility of all parts simplifies maintenance. For details ask for Bulletin 391. Fairmont Railway Motors, Inc., Fairmont, Minnesota.

Performance ON THE JOB COUNTS

OF ALL THE CARS IN SERVICE TODAY

More Than Half are Fairmonts



42 years

OF DEVELOPMENT AND EXPERIENCE

The successful application of roller bearings to any type of equipment requires two basic factors.

FIRST, CORRECT BEARING DESIGN, MATERIAL AND CONSTRUCTION

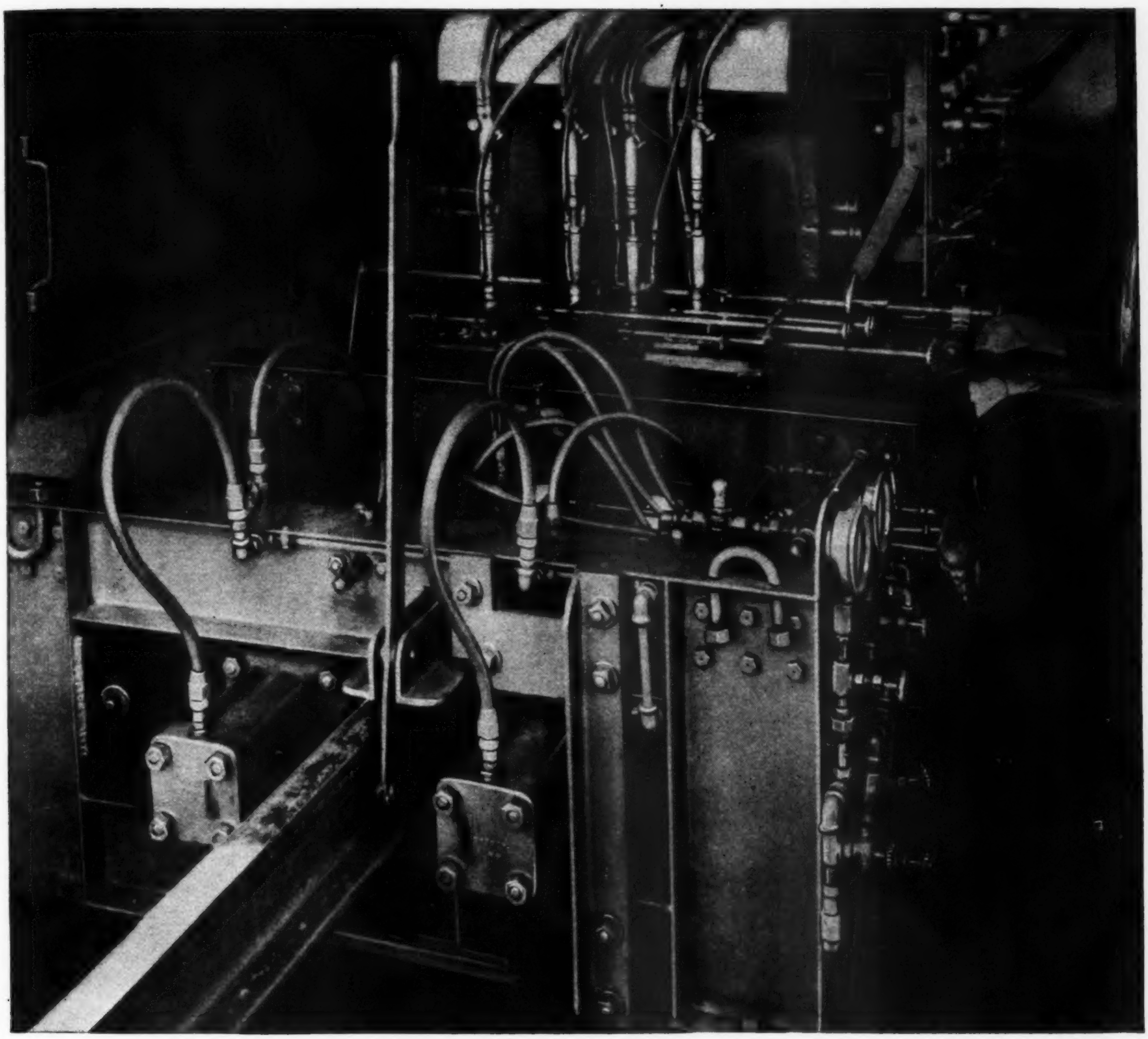
The TIMKEN Bearing of today is the finest tapered roller bearing that has ever been made. Timken history over a period of 42 years is a story of continual improvement in bearing design—in fact Timken has pioneered every important refinement and improvement ever made in tapered roller bearings. Among these Timken achievements are: the one-piece multiple perforated cage; TIMKEN Electric Furnace Alloy Steel; TIMKEN Bearing surface finish, the finest finish known to modern bearing science; and wide area contact between the ends of the rollers and the under-cut rib of the cone, thus assuring accurate roller alignment around the periphery of the raceways, without which high bearing speeds would be impossible.

SECOND, LONG EXPERIENCE IN APPLYING THE BEARING TO MEET THE PROBLEMS OF ANY TYPE OF EQUIPMENT

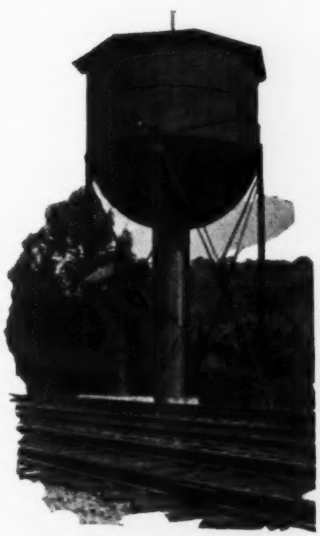
Timken has successfully applied bearings to every kind of mechanical equipment. It takes several years to thoroughly prove the successful use of bearings in meeting the individual specialized problems of any given condition of service. Timken's vast fund of experience takes the guesswork out of bearing application.

When you install TIMKEN Bearings you are not experimenting. You get both of these two important basic factors that are so necessary for dead-sure, satisfactory bearing performance: *first,* correct design, material and construction; and *second,* 42 years of engineering experience in applying bearings.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO




A "JOINT" SAVING



TO RAILWAY SUPPLY MANUFACTURERS

"Bill Knows"

"Bill, the brass hats in the front office have been looking over our sales figures and they're certainly pleased with our results. Our railroad department is leading all the rest," said the sales manager to his star salesman.

"Gee, Boss, that's great," replied the salesman.

"And that's not all, Bill, it's your fine work that's responsible for our success. You're leading our department."

"I'm glad to have you say that, Boss, for I have certainly worked hard, but you're entitled to a lot of credit yourself. You're a great boss."

"Cut out the bunk, Bill."

"I mean it, Boss. You've given me the finest support that any man could want. When I need help you give it to me, and the best help of all is the advertising that you're carrying in Railway Engineering and Maintenance. It helps all along the line."

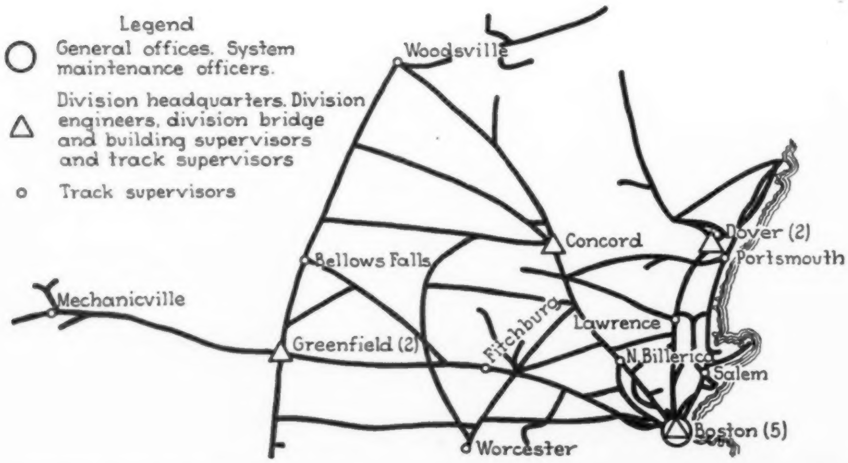
"In what ways?"

"In a lot of ways. These railway maintenance officers read that paper. They even take it out on the line with them."

"But what makes you think they read our advertising?"

"They talk to me about it. They like your copy. You put information in it that they want—and you put it in their language."

"Bill, I'm glad to have your first-hand report from the firing line. We've got a fine product. It deserves good advertising and we'll keep it up."



★

Railway Engineering and Maintenance Goes Every Month to 25 Supervisory Maintenance Officers on the Boston & Maine at the **System Headquarters, at 4 Division Offices and at 9 Other Supervisory Headquarters,** Scattered All the Way from Portsmouth, N. H., to Mechanicville, N. Y. This Magazine Goes Also to 3 Other Subordinate Officers Who Are in Training for Promotion to Supervisory Positions on This Railway.

★

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

Now 62 RAILROADS Use BARCO UNIT TYTAMPERS

Backed by 5 Years' Satisfactory Record

In out of face or gang tamping, they will give you better results at *LOWER COST*

BARCO MFG. COMPANY

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ON EXHIBIT SPACE 70

ROADMASTERS' SEPTEMBER CONVENTION

No. 139 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION
105 WEST ADAMS ST.
CHICAGO, ILL.

July 1, 1940

Subject: Bill Was Right

Dear Reader:

"Do you know what I read first in Railway Engineering and Maintenance?"

This was the question put to me by the engineer maintenance of way of one of our larger railways whom I met on a train a few days ago.

"What is it?" I countered.

"It's those conversations between Bill, the salesman, and his boss," he replied.

"Why do they interest you?" I followed up.

"Because they're so true to life," he said. "I know a lot of these men, for they call on me and I know how hard they work to sell their materials and equipment. As a whole, they're an earnest, capable group of men."

"I'm more pleased to receive this frank and unsolicited comment of yours than you realize," I said, "because I'm writing these dialogs. But what about the point I'm trying to make that advertising helps the salesman?"

"That's the thing that has struck home with me," he replied. "I have subscribed to and read Railway Engineering and Maintenance for years. And I read the advertisements as closely as the editorial pages, for I'm looking for every lead that will help me do my work better or cheaper. I'm posted, therefore, on the materials that are advertised in your magazine and when "Bill" comes in we can get down to business at once, for I know what I want to ask him. Don't forget that his advertising saves my time as well as his."

"Then you, as a buyer, believe in advertising?" I asked.

"I certainly do," he shot back. "I'd be years behind in my knowledge and use of new materials without it. I wish every manufacturer would follow the practice of Bill and his sales manager."

As you look back over your experience, I wonder if you don't share this railway officer's evaluation of the advertising that is published in these pages from month to month. If you do, write me; better yet, write the advertisers.

Yours sincerely,

Elmer T. Howson

Editor

ETH:EW

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

JULY, 1940

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PRINTED IN U.S.A.

Used Extensively in Section Gangs and by Track Walkers

Made in a variety of lengths and for all sizes of Track Bolts

Don't fail to attend the Roadmasters' and Maintenance of Way Convention, and the Track Supply Association Exhibit —September 10-12 — Hotel Stevens, Chicago

BUILT FOR HEAVY DUTY

Woodings-Verona Tool Works

Verona **Pa.**

Railway Engineering and Maintenance

War

Can the Railways Meet the Demands?

THE world is in a period of turmoil today, the like of which it has never before experienced. The strongest nations of Europe are engaged in the most devastating war in history. Lesser conflicts are being waged or threatened in still other quarters. Almost the entire universe is in upheaval.

In this country, as elsewhere, war is now uppermost in the minds of the people. In recognition of this fact our nation is launching the greatest program of military and naval preparedness in its history. Transportation is a vital link in any program of national defense. In a country of vast distances like ours, the railways must bear the principal burden of transportation, as was recognized by the president of the United States in his selection of the president of one of our leading railways as the transportation member on the Commission of the Council of National Defense. It is pertinent, therefore, to inquire whether the railways are prepared to meet any demands that may reasonably be anticipated. The question is very definitely in the public mind today. Railway employees should be prepared to give the answer.

What of 1917-18?

Without doubt, part of the uncertainty regarding the railways arises from the fact that the government took over their operation on December 28, 1917, only a few months after we entered the first World War. Does this fact indicate an inherent weakness in private operation of our railways in time of war? Does it constitute a precedent for similar action today?

At first glance, the answer would appear simple and in the affirmative. The record shows that there was a breakdown of transportation late in 1917. Terminals were blocked, shippers were unable to secure cars for loading materials urgently needed for military purposes, and programs vital to the prosecution of the war were being endangered seriously. On the surface, this evidenced a breakdown in rail transportation. Yet, in reality, this was the effect, rather than the cause. At one time there were more than 200,000 cars under load, standing still, blocking terminals and interferring seriously with the movement of other traffic, to say nothing of reducing the transportation capacity of the roads by withdrawing so much equipment from service. These cars were standing still because there was no place to unload them.

This condition resulted from a lack of co-ordination in the purchase and procurement of supplies and in arranging for transportation in the War and Navy departments, with indiscriminate use of priorities and consequent confusion. Indicative of the conditions that prevailed was the receipt at Hog Island shipyard of anchors for ships before their keels were even laid. As a result of such mismanagement by those in authority, the transportation facilities of the country became facilities for storage rather than for movement.

Corrective Measures

But is there any assurance that the conditions that developed in 1917 will not be repeated? This question can be answered in the affirmative with assurance. In the first place, the War and Navy departments have since corrected conditions at the source by developing measures that provide that materials for their use can be loaded into cars only when it is known at the points of loading that such cars can be unloaded promptly on arrival at destination. Furthermore, the railways themselves are now so thoroughly organized as to eliminate any possibility of congestion. Among other measures they have perfected an embargo and permit system by means of which they can prevent the accumulation of loaded cars beyond the ability of receivers to unload them promptly. Working in co-operation with the War and Navy departments, these measures will insure the free movement of all materials essential to national defense.

As one step in this procedure the railways have created a manager of port traffic with headquarters at New York, with authority to control the movement of all traffic moving to ports for export. The effectiveness of this measure is shown by the fact that in February, 1940, a total of 693,000 tons of freight were moved through North Atlantic ports, as compared with 664,000 tons in the same month of 1918. The magnitude of this accomplishment is emphasized when it is recalled that in 1918 there was congestion at the ports, embargoes were in effect and permits were outstanding for 16,798 cars, while this year, a larger volume of traffic was handled without congestion, delay or embargoes. Lest

we gain an incorrect impression of the real accomplishments of the railways in the last war, it is well to recall that they moved more freight and passengers in 1917 than in any previous year.

What to Expect

It is timely to consider how much of an increase in traffic we might expect if we were plunged into a war directly or indirectly. In an attempt to determine this figure, M. J. Gormley, executive vice-president of the Association of American Railroads, showed, in an address before the Society of American Military Engineers at Washington, D. C., on May 6, that the total increase in traffic from the year 1916, when we were not in war, to 1918, when we were in war, was only about 12 per cent of the total commercial load. And railway men know that an increase of 12 per cent is less than the seasonal variation in traffic that the roads normally experience. As a matter of fact, the increase in traffic from the low week in May of last year to the high week in October was 55 per cent.

This record was made possible by a remarkable improvement in railway efficiency that began with the launching of a vast program of physical betterment in 1923 and that has been reflected in steadily increasing efficiency of transportation movement up to the present. This efficiency is shown, for illustration, in an increase of 60 per cent in freight train speeds, an increase of approximately 20 per cent in the average capacity of freight cars, and in the doubling of gross ton miles produced per train hour.

It was in recognition of achievements such as these that Louis Johnson, Assistant Secretary of War, said on April 26, that the railways "have proven their ability and their capacity and now are better prepared to meet a military emergency than they were in 1917. The government," he added, "is satisfied that the railroads under private management are always in a state of national defense."

Treated Sash

Longer Life Makes It Attractive

IT was a railway that first applied preservative treatment to wood in this country; it was the railways that developed wood preservation to the point where it became a commercial possibility; and for more than 100 years the railways have been by far the largest users of treated wood. They have, therefore, an intimate knowledge of this material, of its possibilities and limitations, and possess in their own records complete information concerning its economy and other benefits that accrue from its use. In view of this accumulated knowledge of the advantages of treated wood, and the fact that every maintenance officer is familiar with its use, it might reasonably be expected that its use in buildings would be as nearly universal as in any other application.

Such is not the case, however, for, compared with the possibilities, the use of treated wood in buildings is negligible, except for such structures as piers, wharves, enginehouses, coal docks, etc., and even here its use is by no means universal. No one has yet advanced a reason why treated wood cannot be used to the same extent in frame buildings that it is for ties, and on some roads this is 100 per cent. Building engineers who have studied the subject admit there is no bar to the use of treated lumber in building construction, although they generally hold that the use of creosoted material should be confined to those parts of the building that are below the floor level.

There is one application of treated material from which unusually attractive benefits can be derived, that has been ignored almost completely. This is the use of treated window frames and sash in enginehouses. Every maintenance officer from carpenter foreman to chief engineer is familiar with the short life of wood sash and frames in enginehouses and knows that steel sash is little, if any, better. Furthermore, both wood and steel sash require frequent painting to obtain even this short life.

Only a few roads have used treated sash, but these roads all report highly satisfactory results from the experiment. Treated wood has demonstrated its ability to withstand the attack of the corrosive gases that are so abundant around enginehouses. It does not need to be painted and it will outlast several installations of untreated wood or steel sash. Only one objection has been raised to it, and this applies to any wood sash, and that is that it reduces the effective window area, compared with steel sash. This is a matter that can be cared for in new construction by increasing the size of the window opening.

Rail Lubrication

Study Necessary for Maximum Benefit

RAPID as has been the adoption of rail and flange lubricators by many roads during recent years to minimize rail and wheel flange wear, it is surprising to many that these devices are not being used still more extensively. In the first place, the practice of lubricating the high rails of sharp curves is not new, because long before the advent of the automatic, track-type lubricator, many miles of rails in heavily curved track were greased manually by means of a swab or stick, or oiled by lubricators attached to locomotives, and in the second place, there are few who question the value of proper rail lubrication.

If there was lack of adequate proof of the advantages of rail and flange lubrication before this practice was put on a practical and economical basis and adopted widely, there should be none at the present time, except possibly as to degree, because most of those roads employing rail lubricators properly and to the best advantage early found that the savings involved were so large and self-evident as to make detailed tests or records of performance unwarranted. These advantages include increased life of the rail—at least double on curves of 10 deg., according to one chief engineer, who has in one territory of 116 miles as many as 391 curves, with combined curvature of 16,452 deg.; less detrimental effect on line, gage and surface, with reduced labor costs and damage to the ties; increased safety of operation; reduced wheel flange wear, the extent of which has all but amazed mechanical department forces; and reduced curve resistance, which becomes of particular impor-

tance in territories of heavy grades with restricted tonnage ratings. Until the recent study made by a committee of the American Railway Engineering Association, there was little conception of the value of rail lubrication in reducing curve resistance. As the result of this study, this is shown to be approximately 50 per cent, which, in the particular territory under consideration, 45.6 miles long, saved the equivalent of 96 ft. of elevation.

Large as are these advantages of rail lubrication, which may make detailed cost studies unnecessary as a prerequisite to their purchase as such for many territories, the selection of the type of lubricator best adapted to the conditions on specific territories, the location and spacing of the different units, and the use of the most satisfactory lubricant—all to insure maximum results at minimum cost—place an important responsibility on maintenance of way officers. This is true because adequate rail lubrication under any conditions involves considerable expense for equipment, lubricants and maintenance, and nothing less than the maximum return on this investment should be accepted as satisfactory.

To determine the most effective and economical location and spacing of lubricators is not a difficult matter, but it requires consideration of a number of factors, including the number, location and degree of curves involved; grades; train tonnages; the amount of traffic; speeds of operation; and the characteristics of the lubricator employed and of the lubricant used, and no maintenance of way officer can feel that he is securing maximum lubrication per dollar expended, or, in other words, maximum rail and flange protection, with the other advantages inherent in rail lubrication, at lowest cost, until he has made such a determination.

Crossties

Mechanical Destruction Still a Big Problem

MUCH has been said and written about the importance of increasing the service life of crossties and, without question, much will continue to be said and written on this subject so long as crossties constitute the major item of expense for materials used in track maintenance, and so long as they present problems that have not been completely solved—problems which are resulting in large losses annually because of the premature destruction of ties by causes which it is not unreasonable to expect will some day come within the realm of complete control.

For many years decay was the arch enemy of crossties, limiting their service life to a few years at most. Mechanical damage was of secondary consideration because decay outstripped it in its destructive effect. Today, however, with the widespread use of preservative treatments which have proved so effective as inhibitors of decay, the major problem with crossties on many roads, in spite of all that has already been done, is outright mechanical destruction, or mechanical destruction abetted by decay which would not occur if it were not for prior abuse of the wood fibres.

Maintenance men have not been ignorant of the change which has taken place in this regard and have not entirely overlooked it, but it is doubtful if most of them realize the extent to which mechanical wear is shortening the life of their creosoted ties, with the large economic loss which this involves. The Santa Fe, through the detailed inspection which it makes of ties removed from the track to determine the cause of failure, knows what is taking place on its lines in this regard, and, as pointed out in the lead article in this issue by R. S. Belcher, manager treating plants of this road, is taking all known steps to overcome it. Of 141,472 representative creosoted ties removed from the tracks of this road in recent years and inspected to determine the primary cause of their failure, Mr. Belcher points out that 47.6 per cent were removed because of shattering and 44.4 per cent because of spike-killing, with only 0.4 per cent removed primarily because of decay.

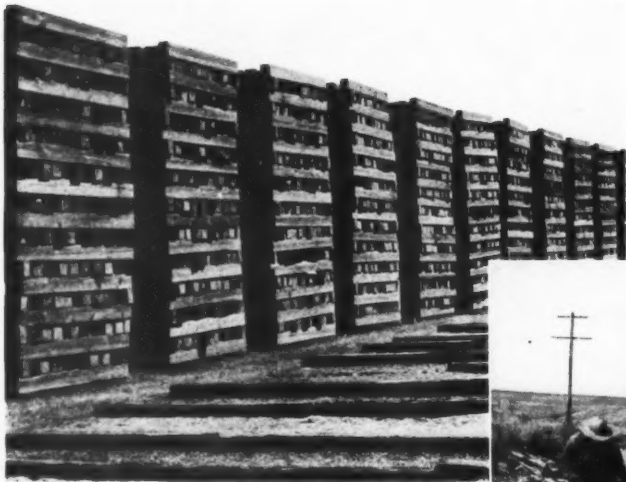
While this record may vary somewhat from that which might be found on other individual roads, it is, unquestionably, with respect at least to spike-killing, typical of that which might be found on the well maintained roads of the country as a whole, and thus shows in marked relief that the present major problem of the railways with respect to their ties, assuming adequate preservative treatment, is to reduce the mechanical damage that is destroying them prematurely.

It is not enough to say that many railways have made remarkable strides in minimizing the mechanical destruction of their ties through the use of larger, double-shoulder tie plates, important as this development has been, because destruction of the ties by plate-cutting where large tie plates are used is no longer the controlling problem. From the records of the Santa Fe, the larger problem is now shown to be shattering and spike-killing. Of these, the former assumes smaller proportions on the railways as a whole because it is not as common on many roads as in the arid or semi-arid regions traversed by the Santa Fe, and besides, this road has found the creosote-petroleum mixture treatment in large measure an answer to shattering.

Spike-killing, on the other hand, is common to every road, and of serious import even where the preboring of spike holes is standard practice, important as this is in reducing damage to the wood fibres when spiking and in insuring the better distribution of the preservative where it is most needed to guard against decay. To minimize this cause of failure, as Mr. Belcher points out, demands every measure to minimize the necessity for respiking, which includes care in rail-laying operations, tie plates of proper design, and thorough anchoring of the track. Where respiking is essential, he stresses the importance of pulling the old spikes with minimum damage to the ties; the use of tie plugs of proper size and design; and the greatest care in redriving the spikes—all of which factors are within the province and control of the track forces.

In 1939, more than 38,000,000 treated ties were laid in replacements by the railways of the United States. If it is assumed that anywhere near 44 per cent of the ties removed from the track were taken out primarily because of spike-killing, with a loss of from 1 to 10 years service life, the large economic loss through the effect of spike-killing becomes so clear that it should challenge every maintenance of way man to do his utmost to overcome it.

Getting the



Every Crosstie That Is Destroyed Prematurely by Inadequate Precautions Against Wear Is An Economic Loss in Material and Labor

Experience of the Santa Fe shows that further increases in the life of well-treated ties must come through improved protection against mechanical wear, especially spike-killing—and the author of this paper looks squarely at the trackman

OTHER than the labor required for maintaining good track, no item on the trackman's list represents as much money over a period of time as crossties. Ties constitute the largest individual item of expense for material used in maintenance. The cost of placing them in track is also large, and it is, therefore, of vital importance to our railways that we get the most out of them.

Last year, tie renewals on all of the railways of this country amounted to some 46,000,000. This is about 4½ per cent of the 1,000,000,000 (in round numbers) crossties in all tracks of all the roads of the United States. Indications are that these renewals, in general, will increase later in the present decade as the much heavier replacements made in the decade prior to 1930 become ripe for renewal. It is our responsibility to offset this probability so far as possible by making the maximum use of the advances which have been made in crosstie manufacture and preservative treatment, and the improvements that have been made in methods of handling ties and in track maintenance generally. To lengthen the life of ties even a little is a matter of considerable financial importance.

*Abstracted from a paper presented before the Maintenance of Way Club of Chicago.

Various designs of metal or concrete ties, or of ties involving a combination of these materials, have been placed in service during the last 30 or 35 years, but they have developed defects of one type or another and none of them has warranted extensive use. On the other hand, advances that have been made in the manufacture, methods of handling, preboring and adzing, and the preservative treatment of wood ties, together with improvements in tie plates and fastenings, have resulted in increasing their service life. Our problem at present, therefore, is to make the most efficient use of the wood tie.

Manufacture and Inspection

A tie is something more than just a stick of wood. It is made to serve a definite purpose. Its functions are to bind the rails together, to hold them to gage, and to distribute the wheel loads to the ballast. Both the purchasers of ties and their producers are interested in the details of their manufacture from the time the tree is cut. Careless or unskilled manufacture may result in the making of a poor tie out of a good piece of timber. To leave a good tie in the woods for too long a time, or in a wet location, will make it so that it will not be worth treating. In short, it is to everyone's advantage, first, that the timber be suitable, then that the tie be made carefully to the railroad's specifications by a skilled tie hacker or sawmill operator, and also that it be moved promptly from the woods to the treating plant storage yard where it can be seasoned under the most favorable conditions.

A proper specification covering the quality and manufacture of ties is necessary, of course, but the specification alone is not enough. To be effective, it must be enforced, and to be enforced there must be competent inspection. And while competent inspection is a necessity from the standpoint of the railroads, the tie producers should be almost as much interested in this regard, because it is well known that incompetent, variable inspection has been the cause of many of the trials and tribulations of the tie producers in the past.

There has been much improvement in tie specifications, manufacture and inspection during recent years, but there is still room for improvement. Ties should be branded by hammer or paint to show their grade, the inspector's number or letter, the month inspected and the initials of the railroad company. Ties so marked can be properly sorted and stacked when they reach the treating plant. Proper sorting and stacking are necessary steps in the seasoning process, and thorough seasoning is necessary to the best preservative treatment.

On the Santa Fe, from a small

Most Out of Crossties—

The Trackman's Responsibility*

By R. S. BELCHER

**Manager Treating Plants,
Atchison, Topeka & Santa Fe System, Topeka, Kan.**

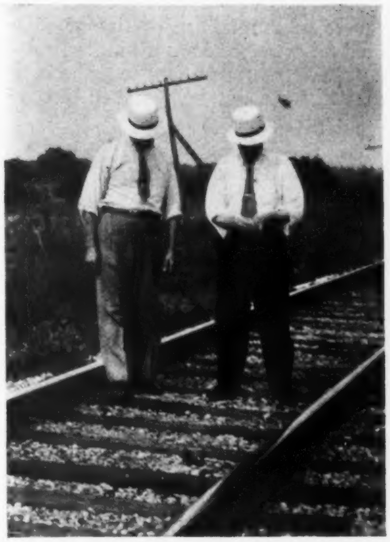
beginning in 1885, we have been treating our crossties in increasing quantities year by year for 55 years. During this period we have treated a total of 116,521,467 ties, in addition to our requirements for piles, switch ties, bridge timbers, crossing plank and miscellaneous lumber. In this paper, I will not attempt to review the story of the research and development which the Santa Fe has carried on during the period of its timber treating activities. Suffice to say here that we believe the well-treated tie is an economic necessity.

It is important that the right tie be used in the right place. Prior to 1922 on the Santa Fe, we had not given a great deal of consideration to the distribution of crossties of the various woods available to us, other than as regards the length of haul from the sources of supply. In that year, a committee appointed by our operating vice-president, of which G. W. Harris, then assistant chief engineer, system (now chief engineer, system), was chairman, made an exhaustive study of the hard and softwood ties available, and the distribution of these woods as to kinds and sizes. This resulted in the assignment of the various species available to those parts of the system to which they are best adapted with respect to availability and climatic and service conditions. Furthermore, a system standard was developed in the form of a map which shows not only the territory in which ties of each kind of wood are to be used, but also the grades or sizes of ties to be used in each class of track.

Special attention has been given by the Santa Fe to the distribution of hardwood ties to insure that they are used where service conditions are most severe, such as on curves of one degree and over, and in engine leads and other important tracks in yards, because of more than 45,000,000 ties laid in renewals in Santa Fe tracks during the last 20 years, less than 7,000,000, or about 15 per cent, were hardwoods. Incidentally, these 45,000,000 crossties renewed represent approximately 75 per cent of all ties in Santa Fe tracks, indicating an average annual renewal of about 3¾ per cent for the 20-year period and an average life of 26⅔ years.

9-Ft. Ties

Recently, the 9-ft. crosstie, 7-in. by 9-in. in the case of sawn ties and 7-in. by 8-in. in the case of hewn ties, was made standard for use in our high-speed and heavy-traffic main tracks, both curves and tangents, between Chicago and Los Angeles, Cal., via La Junta, Colo., and Amarillo, Tex., and in curves only in our other important main lines; 8-ft. ties are used in all other tracks. This action was taken because of the increase in speed of both passenger and freight trains, and came about as the result of an intensive study made by our chief engineer, system, during the last few years to determine what should be done to the track structure to bring it up to the required standard for the faster schedules. A 7-in. by 8-in. by 9-ft. tie provides more bearing area on the ballast and approximately 28 per cent more tamping area than a 7-in. by 8-in. by 8-ft. tie. Likewise, a 7-in. by 9-in. by 9-ft. tie provides 44 per cent more tamping area than a 7-in. by 8-in. by 8-ft. tie, but because of the fewer number of the former being required per mile, due to their same spacing face to face as the smaller ties (the width of a shovel blade), the actual increase in tamping area per mile is approximately 38 per cent. It is believed that by increasing the size of our ties from 7-in. by 8-in. by 8-ft. to 7-in. by 9-in. by 9-ft., we have adopted the most practical and economical method available of increasing the supporting power of our track structure.



Trackmen Must Minimize Mechanical Destruction of the Ties

Causes of Failure

In the course of time, even the best crossties reach the end of their service life. This raises the question, "How does the well-treated tie eventually fail?" If we are to continue to advance, to maintain better track, and do it more economically, by getting a longer and better average service life from our ties, we must determine how the ties that have completed their service life have failed so that we can determine along what lines to make further improvements in methods and materials.

With a view to improving our treatment of ties on the Santa Fe, we have inspected thousands of old ties taken out of the track to see why they failed. Some ties, of course, have showed several kinds of failure at the same time, but we have, so far as possible, classified them by what appeared to be the primary reason for failure. The total of all such ties inspected and tabulated is 644,072.

Some of these were untreated ties of decay-resisting woods, such as redwood and cedar; others had been treated with creosote, zinc chloride, and various other preservative materials.

This classification of failed ties on the Santa Fe is made by inspectors working under the manager treating plants, system. These inspectors, experienced in the treatment and care of timber, co-operate with the division engineers, roadmasters, extra-gang foremen, section foremen and others to determine, so far as possible, the causes of the failure of ties of each kind of wood and each kind of preservative treatment, and to make sure that ties are not being taken out of track prematurely.

What the Record Shows

In this paper, it will be sufficient to show what these inspectors decided were the primary reasons for the failure of 141,472 creosoted ties, especially since creosote, and creosote mixed with petroleum and coal tar, are now used generally as crosstie preservatives on nearly all railroads.

Primary reason for failure	141,472 creosoted ties per cent
Decay	0.4
Shattered	47.6
Plate cut (or rail cut)	2.2
Spike-killed	44.4
Split	2.4
Derailment	2.6
Broken and burned	0.4

This study of ties removed from track has proved of value in the development of our practice with respect to treatment and the selection of tie woods for various climatic, traffic and track conditions over the system. For example, as noted in the foregoing tabulation, of the 141,472 creosote-treated ties taken out of track, 47.6 per cent had failed on account of shattering, and 44.4 per cent had failed primarily because of spike-killing. Only four-tenths of one per cent had failed primarily because of decay. However, decay will occur as a secondary cause of failure in connection with spike-killing; for instance, where the spike-killing has made an opening through which the decay-producing fungi can enter the untreated interior of the tie. Decay will also be found in ties in which poor penetration of the preservative has been obtained, either because of poor workmanship in treatment, which includes insufficient seasoning before treatment, or because of a large percentage of heartwood which cannot be penetrated by the preservative, leaving no sapwood, or only small amounts of treated sapwood surrounding the heartwood.

We have also inspected and tabulated 188,588 zinc-chloride treated ties that have served their time in track. Of these, 62.4 per cent failed primarily because of decay; the remainder chiefly because of shattering. Zinc-chloride treated ties will fail because of decay when the preservative has leached sufficiently from the wood to make what remains no longer toxic to wood-destroying fungi. This is true also of ties treated with most other water-soluble preservatives. So far as ties treated with creosote, creosote-coal tar solution, and creosote-petroleum mixtures are concerned, and to a considerable extent this may be said of ties treated with zinc-chloride and other water-soluble salts, increasing their service life is most feasible through such protection as we can provide against shattering, spike killing, plate and rail cutting, splitting, and the minor miscellaneous reasons for failure such as derailments, breaking and burning.

Shattering

Shattering is due to the effect of climate, the kind of wood, and track and traffic conditions. On the Santa Fe in the past, the failure of a large percentage of our Southern pine ties, and to some extent those of other woods, has been due primarily to shattering. We have minimized this to a considerable extent through the use of the creosote-petroleum mixture treatment, which has a tendency to retard the ingress and egress of moisture, because shattering is due in part to rapid and repeated drying of the wood. The proper distribution of ties as to kinds of wood, to the territories in which they give best service, plays a very important part in combating their early failure because of both splitting and shattering. For this reason, our standard tie map governing the distribution of ties provides not only for the proper assignment of ties by lengths and grades, but also governs their distribution as to kinds of woods to those territories where they will give the best service.

Machine Adzing Provides for the Uniform Seating of the Tie Plates

Plate and Rail Cutting

Tie plates of sufficient size and of correct design are, to a large degree, the answer to plate and rail-cut ties. Much has been said and written on the correct design of tie plates. Possibly a plate that would furnish the maximum protection to our ties is too costly to be justified by the increased tie life it would provide. Conditions of traffic, the kind of ties to be protected, and many other conditions have much to do with the selection of suitable tie plates. On the Santa Fe, we like the canted, double-shoulder plates, punched for hold-down spikes as well as for the rail spikes, and with transverse V-shaped ribs, 3/16 in. deep on the bottom. When our ties are passed through the tie-boring and adzing machines at our treating plants, grooves are cut in the adzed surfaces to fit these transverse ribs, to permit complete initial seating of the plates on the ties in correct relative position to the pre-bored spike holes. The machine grooving cuts the wood fibres to the proper form to fit the plate ribs, whereas, when the ties are not pre-grooved and the ribs are seated under traffic, the treated wood fibres are broken rather than cut smoothly. We believe this is advantageous in obtaining accurate gage, as well as a benefit to the ties. The transverse ribs, seated firmly in the grooves, together with the effect of the hold-down spikes, prevent one of the principal causes of plate cutting, that is, the movement of the plate on the tie.

When rail relay work is in progress, machine adzing of the ties is preferable to hand adzing, because it provides for the uniform seating of the plates. Incidentally, in the case of either machine or hand-adzing of the ties in track, the newly-cut plate seats should be mopped liberally with hot preservative.

Spike-Killing

We estimate that spike-killing is the primary cause of failure of about one-half of our crossties, and it is, perhaps, the most difficult of the causes of failure to overcome. It is often complicated by decay of the wood in the spiking area, caused by the admission of moisture which lodges in the bruised and broken wood fibres. Much may be done to minimize spike-

killing and many of these measures lie within the province of the trackman. It is true, of course, that the preboring of ties at the treating plant is a considerable factor in minimizing the crushing of the wood fibres in the tie-plate area, because the prebored spike holes reduce materially the crushing of the wood fibres by the spikes. Preboring also affords better distribution of the preservative where it is most needed to guard against decay. The value of preboring and adzing is now generally recognized, and it is reported that in 1938, 71 per cent of all ties treated in the United States were bored and adzed prior to treatment; about 3 per cent were adzed only; and 6 per cent were bored only; leaving only about 20 per cent of the ties treated that were not machined.

Without doubt, when the spike is driven into the treated, prebored hole, a long step has been taken toward protecting the tie from the crushing of the wood fibres and decay around the spike, in so far as the first spiking is concerned—but what of the numerous subsequent spikings incident to rail laying, regaging, spacing ties, etc. Ordinarily, prebored ties should have four railspike holes bored at each end of the tie. This will permit reversing the spike positions at some time during the life of the ties, preferably at the time of rail relay. By all means, unnecessary spiking should be eliminated, and that which is necessary should be carried out with maximum care and skill. Spikes should be driven vertically, square with, and snug against the rail, and where prebored ties are used, it follows that to obtain the advantages of preboring, the spike holes in the tie plate must be lined up with the prebored spike holes in the tie so that the spikes may be driven in the bored holes as intended.

Machines Prevent Damage

The correct pulling of spikes is also important. The spike pulling machine has helped to reduce spike-killing because it gives a straight, vertical pull and does a better job than can be done by hand. Right here I would like to emphasize the value of many of the track machines now available, from the standpoint of getting the most out of our crossties. Among these are spike pullers, spike drivers, adzing machines, ballast cleaning machines, and the various machines used to improve track drainage. I hope and firmly believe that from time to time in the future other machines and improvements in the various machines mentioned will be developed, and that these will enable trackmen to reduce the number of spikings necessary, and thus minimize the damage to the ties resulting from this cause—in other words, that the average tie life will be lengthened because failures resulting from the various types of mechanical wear will have been reduced.

Other factors which tend to reduce respiking and, therefore, failures due to spike-killing, embrace tie plates of correct design, such as have been described previously, and rail anchors, the latter because creeping rail produces slewed ties, with the consequent necessity for regaging and respiking, particularly where joints are slot-spiked. "Hit and miss' joints help materially.

The Spike Pulling Machine Is Effective in Minimizing Damage to the Ties

When necessary to respike, the use of well-made tie plugs of A.R.E.A. standard shape and size will minimize the damage to ties. It is important that the tie plugs be of correct size and uniform as to size. A poor plug is worse than none, and an oversize plug may result in a split tie.

Other Causes of Failure

Our tabulation of tie failures shows only a small percentage of failures due to splitting. However, this type of failure is of more consequence than the figures indicate because it is often a contributing factor in the failure of ties due primarily to some other cause, as, for example, shattering. The splitting of ties in track is due not alone to natural causes, such as weathering, changes in moisture content and the resulting stresses in the wood fibre, but also to the slewing of the ties as the result of rail movement; to improper spiking, including the driving of spikes too near the edges of the tie; and to improper plugging—all of which the trackman, by the exercise of good judgment, can do much to overcome.

Tie failures due to derailments, and broken and burned ties, are of minor importance compared with the other causes of tie failure. However, it is well worth while to do what we can to minimize the damage to the comparatively few ties that fall under these classifications. Ties damaged by derailments, wheel-marked ties, and those that have been bruised otherwise, but not broken, should be adzed to remove the crushed fibre, and then creosote, a creosote-coal tar solution, or a creosote-petroleum mixture should be mopped liberally on the adzed surface. The cost of this practice is small in comparison with the benefit to the ties.

Broken ties should come out of the track, but ties not too badly burned often give years of service. It is good practice to protect ties at locations where it is necessary to clean ash pans frequently, by providing a metal covering over them. This covering should rest on furring one inch or more in thickness to prevent the charring of the ties.

Must Overcome Wear

We consider under the heading of mechanical wear most of the causes of failure other than decay and shattering. It is quite probable that shattering is to a very considerable extent induced mechanically as well as by the effects of weathering. It is believed that at least 52 per cent of the tie failures on the Santa Fe may be listed under the general heading of mechanical wear. In this connection, it should be borne in mind that 85 per cent of the ties in Santa Fe tracks are of soft woods, and it is to be expected, therefore, that we would have a greater percentage of failures due to mechanical wear than would be the case on roads in which hardwood ties predominate.

The importance of the careful and efficient handling of the crosstie, from the time it reaches the right-of-way until its service is complete, would be difficult to over-emphasize. To this end, on the Santa Fe, trained men from the treating plant department, experienced in the treating, handling and care of timber, co-operate with the division people. The pulling of spikes, the driving of tie plugs, the adzing of ties in track, the mopping of the plate seats with a hot creosote-petroleum mixture, and spiking, are all given special attention.

Increases in the service life of well-treated ties, in general, must be accomplished by improved protection against mechanical wear, both as regards methods and materials. The trackman has accomplished much in this direction in the past, and it is to him, to a very large degree, that we must look for still longer service life from our crossties in the future.

More Than 245 Million Cubic Feet of Wood Were Treated in the United States in 1939

Wood Preservation Resumed Upward Trend In 1939

Responding to improved economic conditions and greater industrial activity, wood preservation returned to the upward trend in 1939 that it has been following since 1934, except for the slight setback that occurred in 1938. Indicating the healthy condition of the industry, the volume of wood treated in 1939 has been exceeded in only 8 of the 31 consecutive years that complete records of the output of the wood-preserving industry have been compiled. The railways continue to be the best customers of the industry, using 70 per cent of the wood treated in 1939

IN 1939, wood preservation resumed the upward trend which it has followed consistently, beginning with 1934, except for the slight recession that occurred in the volume of wood treated in 1938. In 1939 a total of 245,219,879 cu. ft. of wood was given preservative treatment, an increase of 998,436 cu. ft., or 0.41 per cent, compared with the quantity treated in 1938, according to figures compiled by R. K. Helphenstine, Jr., Forest Service, United States Department of Agriculture, in co-operation with the American Wood-Preservers' Association. While this volume was only 67.7 per cent of the quantity treated in 1929, the peak year for the industry, it was greater than for any year since 1930, except 1937, and has been exceeded in only 8 of the 31 consecutive years that these statistics have been compiled.

For statistical purposes, the material treated year by year is divided into eight classes. In 1939, four of these classes showed decreases and the remaining four showed increases, compared with 1938, ties recording the greatest loss and poles the greatest gain in quantity treated.

Ties Below 50 Per Cent

As in all previous years since the beginning of the wood-preserving industry, the railways maintained their position as the principal consumer of treated timber. Heretofore, this position has been assured by the fact that, without exception, crossties have constituted more than 50 per cent of the total volume of timber treated, and only the railways use ties. In 1939, however, for the first time in the history of wood preservation in the United States, ties fell below 50 per cent of the total volume of wood treated.* This compared with 55 per cent in 1938. Even when switch ties are added, the sum still fails to reach 50 per cent, the combined total for switch ties and crossties being only 47 per cent of the total quantity of wood given preservative treatment in 1939.

A total of 35,748,845 crossties were given preservative treatment in 1939, representing a total volume of 107,246,535 cu. ft. or 26,549,499 cu. ft. less than was treated in 1938. Numerically the decrease was 8,849,833 ties or 19.8 per cent. As in 1938, oak ties ranked first in number with a total of 16,147,408 ties, or slightly more than 45 per cent of the total. Southern pine again maintained its position in second place with 6,854,726 ties, or a little more than 19 per

Treatment of Miscellaneous Material (Ft.b.m.)

	1939	1938	1937	1936
Lumber	186,429,495	116,640,856	118,258,910	73,694,898
Fence Posts	13,819,213	14,206,465	15,985,256	12,266,798
Tie plugs	1,559,314	788,781	870,486	1,238,326
Crossing plank	None reported	807,684	1,379,114	1,364,035
Car lumber	48,204	None	137,544	148,332

*This decrease in the number of ties treated occurred despite the fact that the Class I roads alone not only inserted more ties for renewals in maintained tracks than they did in 1938, but they used more treated ties. The total number of ties renewed in 1938 and 1939 were 41,363,224 and 45,086,393 ties, respectively, or 3,723,169 more ties in 1939. The treated ties used in these years were 33,391,042 and 38,253,538, respectively, or 4,862,496 more treated ties in 1939 than were applied in 1938, so that both absolutely and relatively there was an increase in the number of treated ties applied in 1939.

Crossties (Number) Treated by Kinds of Woods and Kinds of Preservatives—1939

Kind of wood	Creosote (1)	Creosote-petroleum (2)	Zinc chloride (3)	Zinc-meta-arsenite	Wolman salts	Miscellaneous preservatives	Total	Per cent of total
Oak	12,933,660	3,123,649	84,780	....	2,350	2,969	16,147,408	45.17
Southern pine	4,556,551	2,262,758	30,030	....	....	5,387	6,854,726	19.17
Douglas-fir	14,985	3,996,666	92,413	175,019	1,964	32,042	4,313,089	12.06
Gum	1,103,775	632,215	....	....	1,097	2,310	1,739,397	4.87
Lodgepole pine	....	861,898	332,266	....	....	116	1,194,280	3.34
Ponderosa pine	....	1,166,149	1,460	....	....	....	1,167,609	3.27
Maple	150,000	717,180	3	....	....	....	867,183	2.43
Tamarack	....	641,206	100,000	....	....	....	741,206	2.07
Birch	293,788	359,418	....	....	....	....	653,206	1.83
Beech	71,000	354,608	....	....	....	....	425,608	1.19
Hemlock	....	27,632	142,519	....	....	....	170,151	.48
Elm	50,000	12,000	....	....	....	....	62,000	.17
All other	905,224	507,740	....	....	....	18	1,412,982	3.95
Total	20,078,983	14,663,119	783,471	175,019	5,411	42,842	35,748,845	100.00
Per cent of total	56.17	41.02	2.19	.49	.01	.12	100.00	

(1) Includes distillate coal-tar creosote and solutions of creosote and coal-tar.
(2) Includes various percentage mixtures of creosote and petroleum.
(3) Includes chromated zinc chloride.

cent; and Douglas fir remained in third place with 4,313,089 ties, or 12 per cent of the total. Other woods included gum, lodgepole pine, ponderosa pine, maple, tamarack, birch, beech, hemlock and elm, in the order named, representing 19.65 per cent of the total, while all woods other than those named aggregated 1,412,982 ties, or 3.95 per cent.

Of the total number of ties treated in the year under review, 20,078,983, or 56 per cent, were treated with straight creosote or with solutions of creosote and coal tar; 14,663,119 ties, or 41 per cent, were impregnated with mixtures of creosote and petroleum; and 783,471, or 2.19 per cent, were treated with zinc chloride; while all other preservatives accounted for only 0.62 per cent of the total number of ties given preservative treatment. All but 7,813 of the ties treated during the year were subjected to pressure processes.

Of the total number of crossties treated during the year, 22,537,876, or 63 per cent, were bored and adzed prior to treatment, compared with 70.5 per cent in 1938 and 70 per cent in 1937; 3,666,599 were bored but not adzed; 1,190,038 were adzed but not bored; while 8,354,332 ties, or more than 23 per cent, were neither adzed nor bored. This latter figure compares with 9,285,538 ties, or 21 per cent, that were not adzed or bored in 1938.

The quantity of switch ties given preservative treatment in 1939 amounted to 102,231,763 ft. b. m., representing a decrease, compared with 1938, of 3,120,356 ft. b. m., or 3 per cent. In this classification also oak was in first place with respect to the volume treated, the total for this species having been 66,795,006 ft. b. m. or 65 per cent of all switch ties treated during the year. Douglas fir remained in second place with 11,396,237 ft. b. m., or 11 per cent; while southern pine was again in third place with 10,809,337 ft. b. m., or 10.6 per cent. Gum accounted for 4,789,387 ft. b. m., or 4.68 per cent; and maple followed closely with 4,647,014 ft. b. m., or 4.55 per cent. The remaining 3.7 per cent was made up of tamarack, lodgepole pine, ponderosa pine, birch and elm and a few miscellaneous species.

Piles Make Large Gain

An increase of 8,903,776 lin. ft., from 12,751,961 lin. ft. in 1938, to 21, 655,737 lin. ft. in 1939, or 70 per cent, was recorded by piles. Southern pine stood far ahead of other species, with 18,355,180 lin. ft., or 85 per cent. Douglas fir, in second place, was far behind with 2,933,401 lin. ft., or 13.5 per cent; and oak, in third place, amounted to only 148,801 lin. ft., or 0.7 per cent. The remainder consisted principally of Norway pine, western red cedar, and ponderosa pine. All piles treated in 1939 were impregnated by pressure processes, and all but 26,928 lin. ft. with creosote or creosote mixtures.

During the year in review, the wood-preserving industry consumed 163,864,259 gal. of creosote, representing a reduction of 2,319,632 gal.,

(Continued on page 446)

Wood Preservation, 1909-1939
Together with Consumption of Creosote and Zinc Chloride

Year	Total material treated, cu. ft.	Number of crossties treated	Creosote used, gal.	Zinc chloride used, lb.*
1909	75,946,419	20,693,012	51,426,212	16,215,107
1910	100,074,144	26,155,677	63,266,271	16,802,532
1911	111,524,563	28,394,140	73,027,335	16,359,797
1912	125,931,056	32,394,336	83,666,490	20,751,711
1913	153,613,088	40,260,416	108,373,359	26,466,803
1914	159,582,639	43,846,987	88,764,050	27,212,259
1915	140,858,963	37,085,585	84,065,005	33,269,604
1916	150,522,982	37,469,368	96,079,844	26,746,577
1917	137,338,586	33,459,470	83,121,556	26,444,689
1918	122,612,890	30,609,209	56,834,248	31,101,111
1919	146,060,994	37,567,927	67,968,839	43,483,134
1920	173,309,505	44,987,532	70,606,419	49,717,929
1921	201,643,228	55,383,515	77,574,032	51,375,360
1922	166,620,347	41,316,474	87,736,071	29,868,639
1923	224,375,468	53,610,175	128,988,237	28,830,817
1924	268,583,235	62,632,710	158,519,810	33,208,675
1925	274,474,539	62,563,911	169,723,077	26,378,658
1926	289,322,079	62,654,538	188,274,743	24,777,020
1927	345,685,804	74,231,840	221,167,895	22,162,718
1928	335,920,379	70,114,405	222,825,927	23,524,340
1929	362,009,047	71,023,103	226,374,227	19,848,813
1930	332,318,577	63,267,107	213,904,421	13,921,894
1931	233,334,302	48,611,164	155,437,247	10,323,443
1932	157,418,589	35,045,483	105,671,264	7,669,126
1933	125,955,828	22,696,565	85,180,709	4,991,792
1934	155,105,723	28,459,587	119,049,604	3,222,721
1935	179,438,970	34,503,147	124,747,743	4,080,887
1936	222,463,994	37,952,129	154,712,999	4,127,886
1937	265,794,186	44,803,239	183,574,581	4,833,935
1938	244,221,442	44,598,678	166,183,891	4,829,590
1939	245,219,878	35,748,845	163,864,259	4,522,070

*Includes chromated zinc chloride.

Modern Trends in Demand Modern

By E. M. HASTINGS

Chief Engineer, Richmond, Fredericksburg & Potomac, Richmond, Va.*

Off-Track Equipment Is Becoming Essential to the Economical Performance of Many Classes of Work

WE dislike to refer to the darkest days of the recent past, but about the time that the bottom was being scraped and maintenance expenditures were vanishing into thin air there came the cry for better service, faster schedules, lower rates and a multitude of other demands—all at a time when track maintenance had been starved to a point where the reserve strength had well nigh been spent. No record of the years of railroad track maintenance prior to 1930 can ever chronicle in its pages a story comparable to the accomplishments of the maintenance men who shouldered the burden of building up depleted reserves of strength in the years following 1933-34. It has been and is an achievement of which every one, including the lowliest track laborer, may be justly proud.

Since it is obviously impracticable to dwell on all of the factors that must be given consideration in track maintenance in the light of the ever-increasing operating demands, only a few of the more important items will be considered.

There was a time when rails could be continued in service for some time after they had become battered at the joints. However, present-day standards of service require that joints be kept quiet and smooth, thus calling for refinements in maintenance not heretofore practiced. The building up of rail ends to counteract batter is proving to be a real economy as it materially lengthens the effective service life of the rail.

The butt-welding of rails into stretches of up to a mile or more in length is still, in my opinion, in the experimental stage. There are quite a number of such installations and observations are being made frequently to determine their performance. Some very interesting chapters in this development may be written in the near future. My belief is that the expense attached to this type of track construction has prevented it from being tried out on a wider scale during the lean years. My thoughts are revolving around the practicability of the continuous welding of rail in lengths corresponding to those of the track circuits, with the fastenings consisting of standard double-shoulder tie plates and efficient anti-creepers or rail anchors.

Rail-End Hardening

The end-hardening of rails is being practiced on an extensive scale and should result in a considerable reduction in rail-end batter. Also, the use of transverse fissure detector cars has increased to a marked degree as the demand has grown for faster schedules. The detector car is about the best insurance policy a railroad can purchase for its tracks and the development of the cars through years of investigation marks one of the high lights of railway research. Further investigations that have been conducted by the Committees on Rail and on Stresses in Track of the American Railway Engineering Association, through the rails investigation at the University of Illinois, have brought to us a greatly improved rail and a large storehouse of knowledge as to the manufacture and expected service life of rails. It is not too much to hope and expect that the dreaded transverse fissure is on its way out.

Alinement Must Be Refined

Alinement is another item that needs refinement in meeting the demands of high-speed operation. Slight irregularities that a few years ago made no material difference cannot now be permitted, and the alinement of tangents is as important as that of curves. I believe that we are now faced with the necessity of transit lining all high-speed track frequently; no longer can we rely on the track foreman to do this work by eye. There is now available a little instrument for use in lining track, which is easy to use and which will enable the trackman to refine the line of the rails between transit points with an exactness that cannot be achieved by the naked eye.

Curve alinement must be checked frequently and, while not taking sides with the advocates of either the transit or the string-lining method, I venture to say that the detailed lining of curves must be given more attention. If the transit method is used, string lining between transit points or stations will be found beneficial and will help to smooth out the slight angles or kinks. Spirals and super-elevation go hand in hand with the alinement of curves, and recommended practices regarding these phases of curve work have been undergoing refinements.

In this connection, recent reports of the Committees on Track and on Economics of Railway Location and Operation of the A.R.E.A. should be

*Mr. Hastings was president of the American Railway Engineering Association 1939-1940.

Operation Maintenance Methods

Power Tie Tamping Produces the Best Results and the Most Lasting Surface

Maintenance men have done a remarkable job since 1933 in meeting the rapidly changing conditions and increased demands of operation that have prevailed, says the author of this paper, which was presented before the New England Railroad Club, but he points out that the continuing trends in operation, both passenger and freight, demand that still further progress be made by maintenance men in improved standards and methods if they are to keep pace

thoroughly studied by all maintenance engineers. Also, a most instructive discussion of the subject was published in the report of the Track committee that was presented at the convention in 1940. In the matter of superelevation, I think we should be conservative and regulate speed where necessary in order to avoid the necessity for excessive superelevation. Particularly is this necessary where, as on the majority of roads, the traffic is mixed and there are no regularly-assigned tracks for handling passenger traffic exclusively.

Track Surfacing

Track surfacing is a most important factor in these days of high-speed trains; slight irregularities cannot be overlooked; surface at the joints must be constantly checked; the joint ties must be maintained in the proper position and in good condition; and the ballast must be kept clean so that the track will drain properly at all times. Too much attention cannot be paid to the joints. The track foreman should never be allowed to get the idea that the building up of the rail ends is a substitute for surfacing them and that he does not need to worry about them after the welding is done.

In view of the recent trend toward the use of six-hole joints, I believe that the best results can be obtained by using three ties at the joint; that is, by using the supported joint with one tie directly under the rail ends. This practice, of course, puts the ties close together, but I believe that it facilitates joint maintenance. The close spacing of the ties at the joint may indicate the need for more ties per 39-ft. rail; where good stone ballast is used 23 or 24 ties are not too many. Some of the more important lines are now using 24 ties per panel in their heavy-traffic lines.

In surfacing track to obtain the riding qualities demanded by present-day traffic, the use of power tie tampers, especially where rock ballast is used, will produce the best results and the most lasting surface with the most economical use of labor. Proper drainage of the track and roadbed constitutes a problem of long standing and is a greater problem now than before. The increasing axle loads of locomotives and cars, enhanced by high train speeds, are placing added burdens on the track structure and, to secure the best results, such defects as soft roadbed, water pockets and faulty side ditch drainage must be corrected. Even though expenditures of considerable size must be made to effect such improvements, economies will be realized over the long term. What was "good enough" for the days of the recent past will not do for today and tomorrow.

Curve Reduction Work Faces Many Maintenance Men Confronted With High-Speed Train Operation

Importance of Labor-Saving Devices

Present-day operating demands necessitate the use in maintenance operations of all the mechanical devices of proven merit that will show economies. Labor is the large element in track maintenance and labor-saving devices have become almost a necessity. In this connection reference should be made to the splendid reports of the Committee on Maintenance of Way Work Equipment of the A.R.E.A. Practically every machine of any consequence has been reported upon by that committee.

In considering the matter of maintenance machines we should look carefully for those units that do not have to be operated on the track; it is becoming more and more expensive to operate such machines on main tracks and, in addition, the demands of organized labor for the manning of on-track units is sure to make their use more expensive. To illustrate this

point I quote from the report of a sub-committee: "The demand of train service employees that crews be placed on all self-propelled cranes operating on the rails has so greatly increased the cost of their operation that attention is being given to the possible use of off-track machines for the handling and laying of rail." Such demands are tying the hands of the railway maintenance officers in their efforts to effect economies in the use of mechanical appliances for maintenance of way work.

One of the effects of present-day operating demands on track maintenance will be the development of more maintenance machines and a wider use of those already developed. With the tracks being required to handle an increasing amount of traffic at higher speeds it will be imperative that maintenance work be of a more permanent nature and that it be done with greater dispatch and with less manual labor. At the same time the enlarged demands on track maintenance must not force us into large expenditures of labor and material that do not promise adequate returns in the way of real economies; there will be no real benefits derived from intensified track maintenance programs if the expenditures involved absorb all the gains in revenue. The real or final economies must be ascertained before we can say that the solution is profitable. Therefore, I sound a note of caution and recommend that the economic phase of the problem be given careful study.

Research Important

The demand of present-day operating conditions on track maintenance has brought to the front the necessity for more intensive research in respect to track materials, appliances and construction, and also with respect to structures. The Engineering division of the Association of American Railroads now has a research engineer whose work is directed by a research committee of the General committee, Engineering division. Research work is now being prosecuted on a diversity of subjects, including the welding of manganese trackwork, screw spikes and fastenings for butt-welded rail, joint bar manufacture, corrosion from brine drippings, power bolt tension, interrelation of rolling stock and track, and tests are also being conducted to determine the effect on track of freight car trucks operated at high speeds. An investigation into the subject of impact on railway bridges is the most recent project that has been undertaken. These studies, along with the work of the Committee on Stresses in Track and that of the rails investigation, constitute a wide field of research and may be expected to produce much valuable and beneficial information.

I do not venture to predict what kind of track structure is in the making as a result of changed operating conditions, but I am of the opinion that there will be no radical changes from present standards. Rather, I think, there will be a gradual strengthening and refinement of the track structure along the lines we have been following and a definite trend toward uniformity in the design of materials, certainly on those roads having similar traffic conditions. The question of economic justification looms large upon the horizon in any careful consideration of these problems.

Must Have Net Income

In the final analysis, the owners of railway property are primarily interested in net income. Therefore, in view of all of the refinements that must be made to meet the present demands and conditions, maintenance work on tracks and structures must be conducted with the greatest care if the expenditures are to be kept in the proper economic balance. To keep their properties in fine physical condition will profit the railroads little over the long term unless there is sufficient revenue day by day to keep the condition static.

It has been said that "adversity creates opportunity." The adversity through which the railroads of the country have been passing has presented the opportunity for a more complete analysis of major railroad problems when viewed in their relation to the general political and economic situation.

Whatever may be the state of railroad property, whether favorable or unfavorable; whatever the form of management, whether private or governmental; whatever the level of rates or wages; whatever the policy of regulation or finance, the foundation of railroad service and success lies in the permanent way. Hence, every thought and effort that makes for improvement in the physical property promotes the welfare of the railroad and its position in the industrial world, and adds to the welfare of the employees as well. Therefore, the challenge is before the maintenance of way officer. Whatever success may be attained in carrying on the operation and maintenance of the railroads; whatever economies may be effected in the costs of operation, the permanence of the success and the effectiveness of the economies are found in the character of the personnel of the railroad.

Wood Preservation Up

(Continued from page 443)

or 1.4 per cent, from the quantity consumed in 1938. It should be noted, however, that this consumption has been exceeded in only two years, 1937 and 1938, since 1930, and in each of the six years, 1925 to 1930, inclusive, during the 31 consecutive years covered by the record, and was only 62,509,968 gal., or 28 per cent, less than the consumption in 1929, which was the largest ever recorded. The decrease in creosote consumption occurred altogether in solutions of creosote and coal tar, the consumption of straight creosote, both domestic and imported, having increased. The consumption of zinc chloride (1,951,517 lb.) and chromated zinc chloride (2,570,553 lb.) together amounted to 4,522,070 lb., a decease of 307,420 lb., or 6 per cent, compared with 1938.

Mixtures of creosote and petroleum consumed 24,438,774 gal. of petroleum, compared with the 26,741,677 gal. consumed in 1938, a decrease of 2,302,903 gal. This volume of petroleum was used in the preparation of 50,628,963 gal. of such mixtures, a decrease of 5,023,887 gal. compared with 1938.

For the third successive year Wolman salts (1,200,616 lb.) and zinc-meta-arsenite (215,780 lb.) have been segregated from miscellaneous preservatives and are shown separately in the report. These quantities represent an increase of 330,036 lb. for Wolman salts and of 20,827 lb. for zinc-meta-arsenite. Restoring them to their former classification for purposes of comparison, 1,844,361 lb. of miscellaneous salts were consumed by the industry, compared with 1,575,962 lb. in 1938, an increase of 268,399 lb., or slightly less than 11 per cent.

Treating Plants

The number of treating plants in the United States in 1939 was 229, one less than in 1938. Of these, 221 were in active operation, a number never exceeded and equalled only once, in 1938, and 8 were idle. Two new plants were constructed during the year, both of which were pressure plants. Five plants were abandoned, 2 of them being pressure plants and 3 were of the non-pressure type. Of the total number of plants in existence, 180 were commercial plants that treat wood for sale or by contract; 23 were owned and operated by railways, and 26 were owned by public utilities, mining companies, etc., to supply their own needs.

Preventing Accidents

in a Machine Age*

The safety problem has assumed new aspects as improved methods of conducting maintenance work, largely based on the use of power equipment, have come into vogue, but by properly organizing the work and training the men, according to Mr. Schram, a higher degree of safety as well as increased efficiency can be achieved. He also discusses the characteristics of different machines from the standpoint of safety, and reviews certain aspects of the Erie's safety policy that have contributed to this road's success in preventing accidents and injuries

Great Care Is Used in Unloading Rail on the Erie†

By I. H. SCHRAM

Engineer Maintenance of Way, Erie, Jersey City, N. J.

BECAUSE of changes in the conditions under which the maintenance of track and structures is being conducted today, any discussion of maintenance of way accidents, their causes and remedies, should properly treat of the developments in methods of doing work as they are being worked out to suit present conditions of traffic, labor relations and the financial situation. Now, as always, the work of the maintenance department is scattered over the length of the line, through the expanse of freight and passenger yards, on piers, docks and bridges, in tunnels and buildings and on signals where the footing is often insecure. The maintenance of way department has its own system of transportation superimposed on the tracks and on highways, using motor cars and trucks. It has acquired a vast amount of machinery, much of it of an elaborate and complicated nature, to operate and repair, and, as from the beginning, it is still confronted with the problems connected with the handling of many varieties and large quantities of heavy materials and the carrying out of numberless manual tasks.

Problem Has New Aspects

The prevention of accidents has, therefore, become a problem that has assumed new aspects as different methods of doing the work have come into existence but, since the new methods have been developed in these days of safety-conscious supervision, we have been able to plan them, to perfect our new gang organizations and to educate our men in such a manner as not only to obtain a vastly greater efficiency in the conduct of maintenance work but also to secure a far higher degree of safety. The results have been surprising even to those of us who have been working out the details of gang organizations. The almost total absence of accidents in the organized gangs on the Erie, even though they are equipped with much machinery, is the principal reward for the careful planning of such organizations in the interests of safety. This result is accomplished by outlining the work, the location and the responsibility of each workman, machine operator, lookout, flagman and foreman so that there is no bunching, interference, or hazardous placing of men and so that there is no lack of sufficient men for any designated task or of protection for the men from the hazards of traffic. All of these precautions have the effect of showing the foreman how to implement the safety rules as well as to accomplish his work.

This method of promoting safety is adaptable to tasks other than those involving the use of specialized gangs, being equally beneficial when the work involves such routine tasks as unloading ties and rail. At one time these operations were productive of many injuries caused by ties or rails being dropped on the hands or feet of the men. As these materials are generally unloaded from work trains it is important that the work of the train crew be co-ordinated with that of the trackmen so that signals for train moves be given at times when the men will not be subjected to the jerks of the starting train while handling loads.

For training the men in this respect an educational program is required

*A paper presented before a regional meeting of the Safety section, Association of American Railroads, at Buffalo, N. Y.

† In this operation the men occupy definite positions where they are not likely to suffer injuries to their feet. The rail is picked up at its exact center and is swung and lowered in accordance with signals delivered by the foreman. When giving signals governing the movement of the train the work train conductor remains close to the foreman.

each spring when this work is being organized, the object of which is to reach the work train crews and to educate the trackmen, foremen and supervisors in the proper method of grouping, of placing hands and feet so they will not be under the rail or tie when it is dropped, and in the handling of the crane or other machines. Ground men always keep well back from the car from which material is being unloaded so it cannot be dropped on them. The organization for handling rails from cars is carefully worked out so that the use of locomotive cranes (equipped with approved types of tongs) and the handling of the rails, both in the cars and to the ground, follows a planned routine. The installation of ties, rails and similar heavy materials is also worked out along these lines.

Machines Prove Beneficial

One of the features of modern maintenance work is the use of machinery to supplement man power and to relieve the worker of many of the heavy back-breaking tasks of former days. There are many of these machines and each has done its part in not only diminishing drudgery but in eliminating strains, back injuries, ruptures and all the other types of injuries which were formerly common occurrences among maintenance of way workers and which still occur to some extent. However, it is necessary that all of the machines be studied individually from the safety standpoint to forestall the development of other types of accidents. We believe that such studies are necessary, even though practically all manufacturers of such equipment have exerted efforts to protect and shield moving parts.

On the Erie, machines are checked carefully by the supervisor of work equipment for safety features before they are purchased or used and, in addition, after they are put in service, studies are made of possible hazards of operation. Some of our most important machines have been found to be almost free of unusual hazards, while others require careful training of the forces using them.

Among the machines commonly used by track forces are power tie-tamper outfits, ballast-cleaning moles, cribbing machines for removing ballast from between the ties, power ditchers, spreaders, bulldozers, ballast shapers, shovels and drag lines, spike pullers, spike drivers, power wrenches and drills and power tie adzers or scoring machines. Power tools commonly in use by carpenters and bridgemen include saws, wrenches and drills, in addition to derricks, pile drivers and similar units. All the maintenance of way forces, of course, use motor cars and locomotive cranes and the now common welding torch. The hazards of the latter have been thoroughly studied and its use is now fully covered by safety rules. All this equipment should be well maintained, as broken parts often spell accidents. When such equipment is properly used, accidents are very rare.

Operating Tampers Safely

The power tamper, particularly that of the pneumatic type, was one of the first mechanical units to be introduced in maintenance of way work and its use and the organization of the gangs handling it have become highly developed. It has been found that injuries are avoided by properly placing the groups of tool operators so that they do not interfere with each other, with men assigned to move the hose so that those handling the tamping tools will not trip over it, and by having the tampers stand erect to keep clear of possible flying chips. The men are also instructed to stand on the ties to avoid injuries to their feet when jacks are lowered. Moreover, it is important to use hose clamps equipped with cotter key locks to prevent hose ends from flying about if they should become uncoupled, and to have header pipes equipped with clamps and safety chains for the same reason. Where views are obstructed, an alert lookout with a good whistle is a very necessary precaution.

Ballast moles have many moving parts, the guarding of which is essential. In connection with the use of these machines it has been found important to bring them to a stop before any lubricating or adjusting is done and to have such duties assigned to a competent operator. It is also important that the work of handling the dirt conveyor be specifically assigned, that at least two men be used for handling the rack rails and that a competent lookout be assigned. Because of the noise and intensive character of the work, it is also desirable that trains give warning signals when approaching a mole in operation.

Other Machines

The cribbing machine, which is now coming into rather wide use, is quite heavy and its use requires close checking between the foreman in charge and the dispatcher. Other requisites when this machine is in use include careful flagging and well-built set-offs. Screen guards to prevent particles of ballast from flying about are also necessary. Spreader cars are now widely used for ditching and have also been adapted to the shaping and dressing of ballast. They are operated in work trains and as they foul adjacent tracks they require full flag protection. Men should not be permitted to stand on their decks as there is a possibility that they will be struck by the wing braces if there should be an abrupt closure caused by the car striking an obstruction.

When using tie-scoring machines and power adzers, the cutting tools in these units must be maintained to the proper degree of sharpness and the guards must be kept in such condition that the chips will be properly confined. Also, the ballast must be removed to a level below the surface to be cut so that stones will not be thrown about. The smaller machines, such as bolt tighteners, drills and spike pullers, should be placed in the hands of experienced operators trained and educated to take them off the track properly and to stop them completely before the hands are placed near a moving part for lubrication or adjustment.

The locomotive crane in some form is our oldest and most useful machine

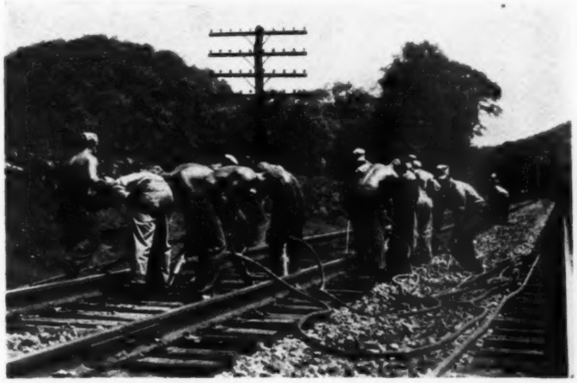
The Operation of Ballast Moles Requires That Close Attention Be Given the Matter of Safe Practices

for heavy-lifting purposes and its use is well understood, parts are well guarded and methods of signaling to the operator are understood. Capacities at different radii should be posted in a conspicuous place on the crane as an upset machine usually means at least one bad injury. Complete and careful flag protection is very essential, as an adjacent track in multiple-track territory is always obstructed when a crane boom is rotated.

Motor Cars and Trucks

Motor cars and trucks are the usual means of transportation for maintenance of way men, and the former have been involved in frequent accidents in spite of the excellent and inclusive rules issued to cover their use. Naturally, rigid enforcement of these rules is necessary as nearly all accidents are caused by violation of rules and not by mechanical defects. Frequent re-examination of car operators on the rules should be a part of the safety program, and efficiency tests should be added. No doubt modern methods of inspecting and maintaining motor cars, and the use of various safety features, such as railings, tool trays, windshields, skids and turntables for removing them from the track, have aided in eliminating mechanical defects. Close co-operation and checking with the dispatching forces is also essential in the operation of motor cars as accurate and prompt line-ups will have a tendency to restrain motor car operators from taking chances that might lead to accidents and injuries.

The precautions to be taken in the operation of trucks used for transporting men are similar to those applying to motor cars, except that the rules for careful driving on highways are those that are enforced. It is also just as necessary to employ careful operators and to have seats for the men that are free from material that can roll over on their feet or hands.



When Power Tampers Are in Use, Injuries Can Be Avoided by so Placing the Groups of Tool Operators That They Do Not Interfere With Each Other

Most of the accident prevention methods that have been outlined have had for their purpose the instruction and education of the individual along positive lines in the correct way of doing maintenance of way work. They supplement the safety rules which are often merely negative. For instance, 37 of our safety rules prohibit things and many others contain the words "must not". These rules are necessary and are the crystallization of past experience, but accidents generally occur through careless or slow thinking and, therefore, we try to help our men in their most common tasks by positive methods, showing them how to do their work in the most efficient manner without risk or injury to themselves.

I know that we have been successful, for of 20 reportable injuries that we had last year none occurred among extra gangs or other organized groups. Four were received in motor car accidents, eight occurred in the handling of material of a miscellaneous nature, two took place when crossing watchmen slipped while walking from their cabins, four were caused by other employees falling or slipping, one was caused when poorly-fitting goggles allowed a welding spark to get into a man's eye, and one involved a scaffold accident. It will be seen, therefore, that those accidents that are continuing to happen are the ones that are the result of "slips" on the part of the individual. Sometimes these consist of rule violations, but more often they involve less important lapses such as too much haste or failure to give enough thought to the matter of footing when handing material or working on ladders or scaffolds.

Safety Meetings

Eternal vigilance is the answer to these hazards and they are minimized when all individuals in the organization become members of the safety movement and make it a subject for continuous comment, conversation and warning. Hazards to safety are also minimized by intensive training of the foremen, whose responsibilities are never neglected. For instance, each of our division engineers holds general safety meetings about four times a year at which not only his staff but also all the employees are invited. The attendance at these meetings is surprisingly large and many trackmen, carpenters and signalmen as well as foremen attend them without compensation. It is, of course, a good time to tell the boss of his mistakes and, with the men doing most of the talking, which they are encouraged to do, many excellent suggestions come from these meetings.

Better Work Also a Result

The principal member of my staff, the general roadmaster, is also the safety supervisor, and he sets the example by never failing to explain some safe practice while he is with a gang. Every supervisor, master carpenter, signal supervisor or other officer follows the same policy, so that every man is aware of the interest that the management takes in his safety. The result is that every employee is becoming a member of the General Safety committee and is seeking to protect himself as well as his fellow worker. It also means that the practice of correcting methods that might lead to accidents is easier for everyone involved and admonitions for violations of safety rules are received in a good spirit. It means, too, that less discipline is administered and that the effect is felt in other ways. Better morale is apparent and this results in better work as efficiency is a concomitant of safe conditions and practices. For instance, in 1938 we had the best safety record in the history of the road in our maintenance of way department, and the unit cost for organized work also reached a new low in spite of higher wages.

However, what we are really proudest of on our railroad are the safety records of two of our divisions. One of them, the Buffalo and Rochester division, had no reportable accidents in 1938, while the other has not had a reportable accident for three years and four months, and had no reportable accidents during seven of the last nine years. In 1938, our maintenance of way department had a safety ratio of 2.1; so far in 1939, the figure is 2.9, and in both cases the ratio is below our 1938 and 1939 goal of 3.0. We know, therefore, that some of our divisions can go years without an accident. Our entire maintenance of way department, as well as that of other railroads, will some day achieve similar safety records.

The Swing Span at North Tonawanda From the North. The Jacking Strut Used In The Restoration Work Was Located In The Right-Hand Channel

Displaced Bridge Pier

Jacked Back Into Position

To restore to its normal position the center pier of a swing bridge, which had been displaced when struck by a barge, the New York Central used a jacking scheme embodying a strut extending from the pier to one of the abutments for the purpose of transmitting the jacking reaction to the abutment. When the pier had been returned to its normal position, the stone-filled timber crib enclosing the foundation was grouted internally to stabilize it in that position

WHEN the stone masonry center pier of a swing bridge on the New York Central was knocked out of line some time ago when struck by a barge, it was restored to its original alinement with the aid of an ingenious jacking arrangement and was stabilized in that position by filling with cement grout the rubble-filled timber crib or box enclosing the timber foundation piles. Among the more interesting features of the jacking scheme was a horizontal timber strut that was constructed to span one of the 70-ft. channels at the bridge site for the purpose of transmitting the reaction of one set of the jacks to one of the stone masonry abutments. Since the completion of the restoration work, the pier has been kept under close observation but to date no appreciable change in its position has occurred.

The structure involved in this project was constructed about 1887, and is a single-track manually-operated rim and center-bearing revolving draw span carrying an industry track across the New York Barge canal at North Tonawanda, N. Y. It has a total length between the faces of the end abutments of about 160 ft. and embodies short timber approach spans behind the abutments.

The center pier of the structure is comprised of a circular stone-masonry cap about 20 ft. in diameter, which is supported on a timber pile foundation that extends up approximately to the level of low water and has a height above the bottom of the canal of about 12 ft. It includes about 50 piles which are enclosed in a box or crib 22 ft. square, the side walls of which consist of 12-in. by 12-in. timbers placed horizontally and mortised at the ends. The crib is filled with rubble and the side walls are tied together on the interior with 6-in. by 6-in. timbers to preclude spreading. A wood platform, consisting of 5-in. by 12-in. timbers, covers the top of the crib and provides the support for the cap, which is 5 ft. in depth.

Extent of Displacement

Several years ago a north-bound barge, moving in the easterly channel of the canal, struck the bridge, severely damaging the south fender and causing the center pier to be shifted out of line to the north and west. This was substantially a longitudinal displacement of the timber layers of the crib, varying in magnitude from a maximum at the top to nothing at the bottom, there being no appreciable change in the location of the bottom of the crib. Also the top of the pier remained substantially level. The loose stone filling, of course, moved with the timbers. The extent of the displacement that took place is indicated by the fact that a diver's examination. of the pier following the accident disclosed that on the north face the top of the crib was overhanging the bottom by a maximum of 17 in. Similarly the maximum overhang on the westerly face of the crib was 14 in.

When an attempt was made to return the bridge to the closed position following the accident it was found

that the westerly end fouled the timber backwall of the west abutment, and that the other end fell somewhat short of coming to a satisfactory bearing on the east abutment. Pending the making of permanent repairs, the backwall of the west abutment was removed to permit the bridge to be closed and suitable means were provided for supporting the easterly end. Also it was necessary to shift the approach rails laterally about 15 in. at the westerly end of the structure in order to effect a closure with the rails on the bridge. To prevent further movement of the pier, batter piles were driven as needed.

A thorough consideration of various methods of correcting the situation at the pier led to the decision to employ jacks, pressing against the northerly and westerly faces, for forcing the pier back into the original position. Since the north fender had been damaged in a subsequent collision, renewal of this structure became desirable, and the new fender, which was installed before the jacking work was undertaken, was so designed and reinforced by means of batter piles as to render it capable of absorbing the reaction of the jacks which were placed along the north face of the pier.

Jacking Strut Provided

However, it was necessary to adopt other measures for absorbing the reaction of the jacks bearing against the westerly side of the pier. It happens that boat traffic on the canal seldom uses the westerly channel at the bridge and for this reason it was permissible to close this channel to permit the construction of a strut between the center pier and the westerly abutment for transmitting the jacking reaction to the latter.

The strut that was constructed to serve this purpose embodied three lines of 12-in. by 12-in. timbers placed in a plane slightly above the level of the water, the two outside lines of timbers being about 9 ft. apart at the shore end and 16 ft. apart at the other end. These timbers were suitably cross-braced to secure the necessary degree of lateral stiffness and were supported by three pile bents, placed on 20-ft. 9-in. centers, each of which embodied three timber piles. This structure had a total length of about 62 ft., with the westerly ends of the 12-in. by 12-in. timbers bearing against the abutment and the easterly ends terminating at a point about 9 ft. from the face of the pier. The space between the end of the strut and the face of the pier was occupied by the jacking platform.

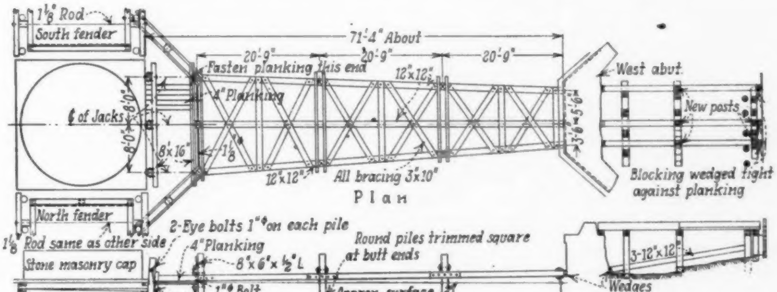
To prevent the outshore end of the strut from spreading under the pressure of the jacks, the outside piles in the end bent were tied together by a 1⅛-in. round rod extending through them. Also the strut was anchored at the same end to the north and south fenders by means of timber tension members extending between each outside pile in the end bent and one of the near piles in each fender. To safeguard the westerly abutment against displacement under the pressure of the jacks, three lines of 12-in. by 12-in. struts were incorporated in the timber approach span, which extend from the back side of the abutment to the backwall of the approach span.

The jacking scheme for the westerly side of the pier involved the use of three jacks placed horizontally, each of which was arranged in line with one of the lines of 12-in. by 12-in. timbers. Since the walls of the crib consist of timbers placed horizontally, the application of force to concentrated points would, to some extent at least, cause the top members in the crib to move independently, leaving the lower members in the displaced position. To prevent this, the pressure from each of the jacks was transmitted to the crib by means of a 12-in. by 12-in. square pile driven flush against the side of the crib. Thus, each of these piles was in continuous contact with the inclined side of the crib for its

plane of the strut between the end of the latter and the side of the pier. One side of this floor was supported and nailed to an 8-in. by 10-in. transverse timber floor beam attached to the end bent in the strut. The other end of the platform (that adjacent to the pier) was supported on another transverse 8-in. by 10-in. timber which was fastened to the three piles driven along the side of the crib. Because these piles were to move forward with the crib as the jacking proceeded, the platform planks were not fastened to the support at this end.

The jacking platform was approximately at the water level and both the 8-in. by 10-in. supporting timbers were entirely submerged. To avoid underwater work, therefore, it was necessary to employ special means for fastening the floor beams to the piles. At the end of the strut this was accomplished by suspending the floor beam by means of 1-in. bolts from an 8-in. by 16-in. timber that was placed across the end bent in the strut just above the platform level, this timber also serving as the bearing block for the jacks.

At the other end of the jacking platform the floor beam was suspended directly from the piles by means of 1-in. bolts. There were two of these bolts to each pile, one on each side, and they were provided with eyes at their upper ends for fastening them to the piles by means



Plan and Elevation of the Strut That Was Constructed to Transmit the Jacking Reaction to the Westerly Abutment. Note Bracing Behind the Abutment

entire height and provided assurance that, as the square piles were moved into the vertical position under the pressure of the jacks, the movement of the different members in the walls of the crib took place at a uniform rate, thereby causing the crib to act as a unit as the jacking proceeded.

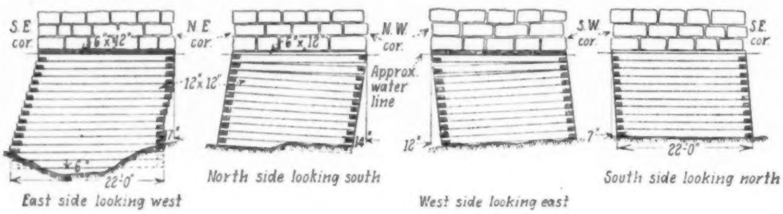
The Working Platform

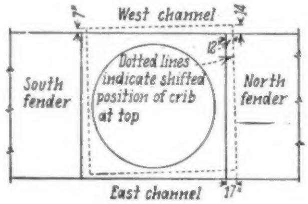
To provide a working platform for the jacking operation, a floor of 4-in. planks was constructed in the

of 1⅛-in. bolts. These hanger bolts extended through the timber floor beam on an angle and were threaded at their lower ends and fitted with nuts.

The jacking arrangement that was provided at the north side of the pier likewise embodied three square piles driven along the face of the pier and a jacking platform substantially similar to that described above. But here, however, the jacking reaction was absorbed by the new timber fender, which is largely of con-

ventional construction except for the batter piles that were incorporated in it as a means of increasing its stability against longitudinal pressure from the direction of the pier.





Elevation of the Four Sides of the Pier and a Plan Showing the Extent of the Displacement As Revealed By a Diver's Examination

There are six of these piles, which were divided evenly between the second and fourth bents in the fender from the south, or pier, end. They were driven at an angle of 30 deg. with the horizontal.

Six Jacks Used

In the jacking operation a total of six ratchet jacks were used, three each along the north and west sides of the pier. Except for the middle jack on the west side of the pier, which had a capacity of 100 tons, all the jacks were of the 50-ton size. With two men operating the 100-ton jack and one man on each of the 50-ton units, the jacking operation was accomplished without mishap in about 3½ days. During this period the crib was kept under close observation, with the aid of a diver, for the purpose of detecting any distortion, but no difficulties of this character were encountered. When the jacking operation had been completed, the jacks were replaced with blocking, which was left in place until the grouting of the pier had been finished.

An examination of the crib had shown that the stone on the interior fell somewhat short of reaching to the top and for the purpose of making up for this deficiency and of filling in the larger voids in the rubble, holes were cut in the corners of the timber platform, through which crushed stone was inserted. This was followed by the grouting operation, which involved the introduction of a mix, consisting of 25 per cent Portland cement and 75 per cent water by volume, into the interior of the crib through the holes in the corners of the timber platform as well as through holes drilled down through the stone masonry cap. An integral aspect of the latter phase of the work was the grouting of the masonry cap itself, which had suffered considerable deterioration through the disintegration of the original lime mortar.

The procedure that was employed in this phase of the work is one that is used extensively on the New York Central in the grouting of stone masonry piers and abutments. In this procedure, holes are drilled down through the masonry structure with a 6-in. shot core drill and when seams or voids are encountered the drill is withdrawn and grout is poured into the hole until the voids in the immediate vicinity have been completely filled. When the grout has solidified sufficiently, the drilling is resumed and is continued until the next seam or joint is encountered, after which the grouting process is repeated.

In the project at North Tonawanda two such holes were drilled in the pier cap on the north and south center line (at right angles to the bridge center line). To obtain the maximum benefit from the grouting operation, the holes were drilled at an angle, the lower ends being directed toward the center of the pier. Each hole was projected entirely through the masonry cap and timber platform and was then used as an opening through which to pour grout into the interior of the crib, this process being continued until the crib had been entirely filled with grout. Preparatory to filling the holes themselves with grout, three ½-in. round rods were inserted in each of them to serve as reinforcing. While the grouting work was in progress it was noted that in several places the grout was escaping through crevices in the sides of the crib, and to prevent further loss of the material in this manner a diver was employed to close the holes.

After the grouting had been completed and a sufficient amount of time had elapsed to permit the cement to set properly, the jacking strut was removed from the westerly channel, but the timber blocking that had been placed along the north side of the pier when the jacks were removed was allowed to remain in position. Following the removal of the jacking strut, no appreciable movement of the pier took place and up to the present the structure has not varied perceptibly from the position in which it was placed by the corrective measures.

The work of straightening and stabilizing the pier at North Tonawanda was carried out under the general direction of A. W. Carpenter, engineer of bridges of the New York Central Lines, Buffalo and East, and under the direct supervision of H. I. Hoag, division engineer at Buffalo, and J. K. Bonner, supervisor of bridges and buildings at that point. W. E. Malott, general foreman of drillers, was in direct charge of the drilling and grouting operations. The jacking strut and the new fenders were built under contract, while all other work, including the jacking, drilling and grouting, was carried out with company forces.

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What's the Answer?

Long Ties at Soft Spots

Is there any special advantage in the use of long ties at soft spots and across swamps? If not, why? If so, what length?

Study Soil Conditions

By G. S. Crites
Division Engineer, Baltimore & Ohio, Punxsutawney, Pa.

Soil conditions should be studied carefully before resorting to long ties as a remedy for or improvement in adverse track conditions over yielding subgrades. Usually, if the subgrade cannot be drained satisfactorily, the solution will be a mat or sub-ballast. Long ties do not add particularly to the area over which the traffic loads can be distributed through a reasonable depth of ballast and sub-ballast. Where ties much longer than standard are used, there is a tendency to depress or trough the subsoil outside the rails and to bulge it upward in the area between the rails, thus producing center-bound track.

Where drainage or mats under the ballast are out of question, as over swampy ground, uniformly and rather closely spaced ties, in lengths up to 10 and 11 ft., will spread the loads to the poor subgrade. In such places, however, more than in places where proper sub-ballast can be provided, care must be exercised not to place ties that are too long.

In almost all cases, ties more than 11 ft. long tend to depress the subsoil at or near the ends, at the same time causing that near the center of the track to bulge or hump, and in not a few instances to work up through the ballast and squirt through the openings thus formed in a manner similar to grease that is being ejected from a grease gun. When this happens, the average trackman will tamp the long ties near the ends, thus aggravating the trouble. Generally, the use of long ties at soft spots and across swamps is not justified, and in the long run may cost more in labor and material than would be necessary for the correction of the condition they are intended to relieve.

Yes, But Not Too Long

By W. Rambo
Roadmaster, Missouri Pacific, Poplar Bluff, Mo.

There is a special advantage in the use of long ties at soft spots and across swamps, especially where the standard crosstie is only 8 ft. long. An 8-ft. crosstie does not have sufficient length to give adequate support from the rail to the end of the tie in soft spots. As a result of this inadequate support at the ends of the ties, the track tends to get out of level and to become center bound. Wherever the latter condition exists, it is not uncommon for the ties to break at the center. In any event, it is necessary to expend an excessive amount of time and effort to keep the track in line and surface.

Experience indicates that one can also use ties that are too long. I believe that 9 ft. is the correct length for ties that are to carry the track over soft spots and across swamps. I believe further that ties of this length should be used on all heavy-traffic lines, regardless of soft spots or swamps. In other words, I believe that the time has come when we should adopt the 9-ft. crosstie as the

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in September

1. *What hazards are involved in "driving" rail to secure expansion? How can they be overcome?*
2. *What disposition should be made of material left over when a building job is completed? Of usable second-hand material? Why? Who should be responsible?*
3. *Is vitrified clay pipe suitable for use under highway crossings? Private crossings? If not, why? If so, under what conditions?*
4. *What are the relative advantages of concrete walls, concrete plank and creosoted-wood plank for bulkheads for open-deck trestles? For ballast-deck trestles? Are there any disadvantages?*
5. *What is the best method for removing a scant growth of weeds and grass from stone ballast? From gravel ballast? What are the advantages? How does the cost compare with other methods?*
6. *What are the advantages, if any, in placing air-relief valves at high points in pipe lines. How high should the crest be to warrant the installation? Are there disadvantages?*
7. *Should section foremen be required to make detailed inspections of rail for indications of approaching failure on lines over which detector cars are being operated? If not, why? If so, how often and in what detail?*
8. *Should paint gangs paint both bridges and buildings or should the painting of these structures be done by separate gangs? Why?*

standard for all primary main lines.

I am also in favor of spacing ties of varying width by measuring the distance between the faces of adjacent ties, rather than from center to center. I am unable to see any good reason for applying 24 ties that are 9 in. wide in one 39 ft. rail and applying the same number of ties that are only 8 in. wide in the 39-ft. rail adjacent to it. Furthermore, I believe that all crossties should be applied so that the center of the ties coincides with the center of the track. This is in contrast with the present practice of having all ties lined so that their ends will be even on one side of the track. If this is done, it is possible that the appearance will not be as pleasing, but the bearing will be more uniform.

Recommends 9 Ft.

By J. L. MONK
Section Foreman, Southern Pacific, Tombstone, Ariz.

It has been my experience that the most suitable tie for use across soft spots is 7 in. by 9 in. by 9 ft. This will add approximately 27 per cent to the bearing on the ballast, compared with a tie 7 in. by 8 in. by 8 ft. I would not, however, confine the use of the 9-ft. tie to soft spots, for I believe that enough benefit can be obtained from their use, in reduced cost of labor for maintaining line and surface, to warrant their adoption as standard for all important main-line tracks. Increased wheel loads and the consistently faster service that the roads are providing have made it necessary to strengthen the track. In most cases this effort has been confined to the use of heavier rail and accessories. It is about time that we gave some thought to longer ties.

Only Temporary

By L. G. BYRD
Supervisor Bridge and Buildings, Missouri Pacific, Poplar Bluff, Mo.

The use of long ties, that is, ties longer than 9 ft. to support the track across soft spots or yielding ground, should be viewed as a temporary expedient only. Where ties are longer than 9 ft. it is practically impossible to maintain a uniform bearing under the full length of the tie, for which reason, when it becomes necessary, as it sometimes does in an emergency, to install unusually long ties over a soft spot, the installation should be regarded as temporary. We have often found it desirable, say in restoring an embankment damaged by a washout, to support the track temporarily on bridge stringers or long switch ties, until the bank could be solidified and permanent arrangements made for supporting the track. During this period, generally, the track is not safe for high or normal speeds and is, therefore, covered by a slow order. The long ties may be useful during this period of consolidation, but experience has shown that they are not adapted for normal use.

Cutting Off Foundation Piles

How far above ground-water level is it safe to cut off untreated piles? Treated piles? How is this determined?

Recommends Treated Piles

By W. R. WILSON
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

Wood that is kept continuously dry or continuously submerged in water does not decay, regardless of the species or the presence of sapwood. It is safe to cut off piles at the ground--water line, or at a distance above the ground-water line to which sufficient water will be drawn through capillary attraction to prevent the growth of fungi. The height to which water will be drawn by capillary attraction will depend on the species of wood, and is variable, so that, for all practical purposes, the cutoff for untreated piles should not be higher than the ground-water level.

Since piles are usually cut from small trees, which, in general, have relatively wide zones of sapwood, with low resistance to decay, piles that are to be subjected to fluctuations in moisture content should be treated. In this connection, the Manual of the American Railway Engineering Association recommends a full-cell treatment of 12 lb. of creosote per cu. ft. for piles having less than 2 in. of sapwood, and 16 lb. for piles having more than 2 in. of sapwood. Treated piles can be cut off at any elevation, this elevation being independent of ground-water conditions.

Accurate determination of the ground-water level often presents serious difficulties. The water table is not a level or uniform surface, but the height varies by reason of the configuration of the earth's surface and in conformity with local geological conditions. For this reason, a determination of the height of water from existing wells, open pits, ponds, etc., located at some distance from the site of the foundation does not always give a true measure of the elevation of the water table at the site. Test borings, which should be made to determine the characteristics of the ground supporting the pile foundation, will give information as to the elevation of the ground water at that location.

Where untreated piles are to be used and cut off near the ground-water level, consideration should be given to the probable lowering of the top of the water table. Included among the causes contributing to this are a cycle of dry years, excessive pumping for irrigation or water supply, and the construction of storm sewers or other drainage works. Engineering literature makes reference to several instances where expensive underpinning became necessary by reason of decay in untreated timber piles, caused by the lowering of the ground water. It follows that treated piles should be used for permanent structures in all cases, except where the entire pile can be placed below a line beneath which the ground water will not be lowered.

At or Below Water Level

By F. H. CRAMER
Bridge Engineer, Chicago, Burlington & Quincy, Chicago

Wherever conditions will permit and where the expenditure to do so will not be excessive, untreated piles should be cut off at such an elevation that the top of the pile will be below the ground water at its lowest stage. Where physical conditions or cost considerations make it impractical to do this, some alternate plan should be adopted, such as the use of treated piles.

In any event, due consideration should be given to probable changes in streams or drainage projects that might affect the elevation of the underground water table. Where it is reasonably certain that the lowest stage of the ground water will not be depressed still further by drainage or the deepening of existing channels, I would not hesitate to cut off piles at elevations 6 in. to 1 ft. above this level. However, because the underground water table fluctuates considerably between wet and excessively

dry periods, it is good practice to embed the heads of the piles in concrete, as this will reduce the opportunity for decay-producing organisms to enter the wood.

If it becomes necessary to place the base of the footing of an abutment or pier above the extreme low-water elevation, the piles should be of reinforced concrete or of creosoted wood. If treated piles are used it does not make much difference how far above the underground water table they are placed. From experience we know that a treated pile will last a long time, and if the tops of the piles are embedded in the concrete there will be practically no danger of decay.

What Size of Air Compressor?

What size of air compressor is most suitable for a building gang? For a bridge gang? What tools should be operated from such a compressor?

Need Ample Capacity

By Supervisor of Bridges and Buildings

One of the serious mistakes often made is to cut down on compressor capacity. If one is going to use pneumatic tools he needs ample compressed air to run them; otherwise, he is going to be seriously handicapped in the prosecution of his work. A building gang needs power saws, hammers, wood borers, drills and a variety of similar tools, any one or more of which may be in operation at some particular time. A bridge gang needs substantially the same tools, but of larger size, so that the air consumption may be greater.

I do not advise going to an extreme in compressor capacity, but because of the wide range of work covered by these gangs, they should be prepared for any eventuality, since a compressor unit cannot be laid aside at will and another that is larger or smaller substituted for it. On this basis, while a compressor capacity of 120 cu. ft. will meet the needs of many situations in building work, there are so many occasions when 160 cu. ft. is needed that I would make this the minimum. For the same reason, no bridge gang should be expected to get along with less than 180 cu. ft. In considering the question of compressor capacity, it should not be overlooked that the higher the capacity, the larger, heavier and more unwieldy the compressor unit becomes.

Needs Cover Wide Range

By General Inspector of Buildings

Like so many other questions relating to railway maintenance, this must be answered first in somewhat general terms, since both bridge and building work cover so wide a range of requirements. Obviously, a gang of building carpenters averaging four or five men engaged on light repairs will not need so great a compressor capacity as a gang of 18 to 20 men that is engaged in an extensive job of alteration or enlargement. On the other hand, the smaller gang may be assigned temporarily to work that will require more compressor capacity than the larger gang can use to advantage. The same is true of bridge gangs engaged in the maintenance or replacement of timber trestles, while the requirements for a structural steel gang may differ widely from the requirements of either.

My experience has confirmed me in the belief that it is far better to have some excess compressor capacity than to be caught with an insufficient amount to meet requirements. In the latter event, the operation of the gang may be seriously handicapped and its productive capacity greatly reduced. I would not assign a compressor of less than 160 cu. ft. capacity to a building gang. It is true that this may be greater than is required much of the time, but no carpenter gang knows 24 hours in advance what its assignment for the next day will be. It is desirable, therefore, not to cut the capacity too far. Likewise, I would make the minimum for a bridge gang 180 cu. ft., since the pneumatic tools used on bridge work generally consume more air than those designed specifically for the use of house carpenters. This same capacity should meet the needs of a steel gang, since this capacity will run three or four riveting hammers, depending on the location of the air-storage reservoir.

Carrying Tools on Motor Cars

What precautions should be observed when loading tools to be carried on motor cars or trailers? Is any special provision for carrying them desirable? Why?

Constant Watch Required

By F. H. McKenney
District Engineer Maintenance of Way, Chicago, Burlington & Quincy, Omaha, Neb.

Because of the inherent danger of serious accident in the event that tools work off of motor cars or trailers, it is necessary that every precaution be taken to insure that they will be loaded in such manner that they cannot fall off. On the Burlington, all gang cars are equipped with wire mesh on the front of the safety railing, to prevent tools from working off and falling in front of the car. This protection is not provided for the rear of the car, but by rule it is forbidden to operate a car in reverse farther than to the first setoff or other point where it can be turned. Trailers should never be pushed ahead of motor cars.

Almost all motor cars are now equipped with tool trays deep enough to hold small tools and material, and care must be taken to insure that the tools are not piled too high in them. Racks are provided at the front of some cars to permit shovels to be carried in an upright position, so that they cannot slip off, as might occur if they are laid on top of the tools in the tray.

Edged tools should be carried in special cases, or protected in such a way that no one can be injured by coming in contact with them. In the case of bridge, carpenter or other gangs that must move many tools, these tools should be transported in specially-designed tool boxes, which are usually left at the site of the job until it is completed.

When it becomes necessary to load trailers or rubble cars with tools, care should be exercised to load them in the center of the car and protect them, if it is possible to do so, so that they cannot shift. One man in the gang should then be delegated specially to watch for any movement of the tools on the trailer.

Careful supervision in loading tools and materials; observance of safety rules in the operation of motor cars

and trailers; and constant watching of the load en route will eliminate accidents caused by tools falling off.

Accident Hazard Serious

By C. E. Miller
Assistant Engineer of Maintenance, Chicago & North Western, Chicago

Maintenance-of-way officers have stressed the necessity for loading tools safely on motor cars ever since these cars came into use, for it is well recognized that the accident hazard connected with unsafe loading is most serious, and that it is quite likely to result in major injuries and even fatalities. However, to assure safety in loading tools, it is first necessary to provide motor cars that are equipped with proper tool trays and other safeguards.

Tool trays, to be adequate for this purpose and safe, must have sufficient length and depth to accommodate standard tools to be carried, and they should have high or screened front ends. There must also be metal or timber guards along the sides of the seat deck, to house the engine and other moving parts so that they will not be fouled by any shifting that may occur by the tools carried in the tool trays.

Probably the most dangerous tools, from the standpoint of loading and transporting on motor cars, that are carried ordinarily on a trackman's motor car, are lining bars and track jacks, that is, provided they are not loaded in such a manner that they cannot fall off. Almost all standard section cars of modern design are provided with tool trays of sufficient length and depth to permit lining bars and claw bars to be laid flat in the bottom of the tray where there will be no possibility of their working out.

Sometimes, however, despite this provision, these bars are loaded carelessly on top of other small tools, where they may be dislodged by being stepped on, or they may work over the end of the tool tray by reason of vibration of the car. Obviously, this manner of loading invites disaster and justifies severe discipline.

Track jacks should never be loaded on the front end of a motor car, for a derailment is almost certain to occur if a jack falls in front of the car. In many motor cars of modern design, a track jack may be placed at the rear of the tool tray, with its base secured between the end of the tray and the lift rail. In any event, jacks should be placed at the rear of the car and at the bottom of the tool tray, which must have sufficient depth to prevent properly loaded tools from falling out. Smaller tools and supplies may be loaded at the front and central portions of the tool trays, reserving the space at the rear for the track jack.

Great care must be exercised to place and hold adzes, scythes and other edged tools so that the occupants of the car will not be cut by them. Unless a special rack is provided or adzes are removed from the handles, it is best to place them at the end of the tool tray, with the blades down, so that a foot injury will not occur if one steps on them.

It is necessary frequently to double up section gangs to carry out certain work and, to avoid taking out two cars, there is sometimes a tendency to overload one car with men and the tools needed to supply both gangs. This should be guarded against, since the crowded seat deck may interfere with the freedom of action of the motor car operator and prevent him from handling the car properly. It may also cause the tool trays to be overloaded. The remedy is to take out two cars, each loaded properly.

This entire matter is one of supervision. Any experienced foreman, with the proper sense of safety, can readily see whether the tools and material he is to transport are loaded securely. He and all members of his gang should be alert to see that the load does not shift as the car proceeds.

Should Backfill Be Puddled?

Is there any advantage in using water for puddling when back filling around foundations? Over pipe lines? Any disadvantage? Why? How much water should be used?

Depends on Material

By J. P. Hanley
Water Service Inspector, Illinois Central, Chicago

Whether there will be any advantage in the use of water when back filling excavations, will depend in large measure on the coarseness of the excavated material, or other material that is to be used for the back filling, the percentage of voids, the economy and availability of the water supply, the possibility that adjacent premises may be flooded and whether there are objections to allowing the surplus material to take natural settlement. In excavations where a finished top surface is required at the time of completing the work, it is advisable to puddle the backfill and remove all surplus material before applying the top soil.

When water and sewer lines are laid in streets, wetting and puddling are desirable as they reduce the subsequent settlement so that the final finish or street surface can be applied sooner. When water lines or sewers are installed in untraveled areas, wetting and puddling are seldom necessary. In this case the surplus material may be applied as a crown and allowed to take natural settlement. However, in all cases, it is advisable to tamp the backfill under and around the sides of the pipe or sewer tile, up to a point equal to two-thirds of its diameter above the bottom, to insure that it is firmly embedded and supported both vertically and laterally.

The amount of water to be applied will depend on the location and nature of the back fill. If surplus water will flood adjoining property or cause criticism, its use should be limited to the minimum required to soften the back fill. If no such objections are likely to arise, the excavation may be filled from one-half to two-thirds full, after which it should be saturated. If the material employed for the back-filling is hard and lumpy, a large amount of water will usually be required. If the filling is loose fine clay or top soil, full settlement may be obtained with only a moderate amount of water; and fine material like sand will require little or no water.

Should Be in Layers

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

It is always preferable to place pipes in such a way that they will hold a uniform line and will lay accurately to grade. To insure that a pipe line, whether it be for water or for sewage, will function satisfactorily, the installation should be made carefully; otherwise one can expect to have trouble from the collection of sediment or settlement of waste. In many instances careless or indifferent installation may result in damage to the pipe lines.

When a pipe trench is being back filled, the filling material should be brought up in layers on each side of

the pipe and tamped thoroughly to a uniform height over the pipe line, just as we do with a pipe culvert. This will insure that the pipe line will not be displaced vertically or horizontally by later settlement of the overlying filling material. Where this material is dry and rough, puddling is necessary to allow the material to soften and become sufficiently plastic to flow into place and pack and thus eliminate settlement.

This applies equally to the filling around foundations, piers, abutments and walls. Where puddling is not carried out satisfactorily and in such manner as to equalize the pressure around the foundations, pipes, etc., there is always danger that the filling material will create greater pressure at one point or on one side of the structure, causing it to be pushed out of position. Not infrequently, unequal pressures result in serious damage, where no effort or inadequate efforts are made to protect the pipe lines or foundations while the filling is being placed, or to support the structure after the backfilling.

The amount of water to be used will depend in large measure on the kind of material and on its condition at the time of use. Puddling around foundations and over pipe lines, if done properly, will decrease the amount of settlement, and will permit the placing of live and dead loads over the pipe lines and on the foundations much sooner than sometimes is possible where natural settlement is depended on, and may eliminate the necessity for slow orders or decrease the time they must be in effect.

We have suffered serious damage to pipe lines in various kinds of soils, owing to failure to employ correct methods for protecting them when back filling. Materials such as sand and clay mixed will not require as much water as gumbo or clay unmixed with sand, or in fact any other material that does not pulverize enough to pack thoroughly as it is placed. However, if one is dealing with gumbo, he will need to place it in thin layers, dampen it and tamp it thoroughly. In other words, all materials require puddling if quick settlement is desired, but gumbo, by reason of its moisture-holding characteristic, may be placed more satisfactorily by tamping than by puddling. If the gumbo has a relatively high sand content, as sometimes occurs where it is encountered in alluvial soil, it may require the same treatment as clay and sandy mixtures. If the gumbo has been removed from the excavation and allowed to become thoroughly dried out, considerable water may be needed to restore it to a workable condition.

How Many Applications?

Where weeds are destroyed by chemical applications, at what period of growth should the application be made? Why? Is more than one application necessary?

Avoid Hot Weather

By J. L. Starkie
District Engineer, Atchison, Topeka & Santa Fe, Topeka, Kans.

Chemical solutions are applied to the ballast and roadbed section for the dual purpose of killing growing vegetation and sterilizing the soil. When applied to green foliage, the chemical is absorbed and carried to the roots, killing the plant, and that part of the solution which reaches the ground sterilizes the soil, preventing seed germination and root development. The practice on this road has been confined largely to the treatment of rock-ballasted track. Chemicals having various concentrations in water are used, the poisonous type being applied between stations where the right of way is fenced, and the non-poisonous type being used at stations.

The proper time to apply chemical treatment for weed destruction will depend on the character and type of vegetation to be destroyed, on the climatic condition, on the nature of the soil and on the stage of growth. Application during extremely hot weather should be avoided. In the more southerly latitudes, our treatment is started late in May or early in June, and continues northward as the season progresses. On lines over which my jurisdiction extends, in Kansas and Oklahoma, applications are ordinarily started late in June and extend northward and eastward during July and August.

Experience and observation indicate that to insure best results, applications should be made just before the plants reach maturity, and definitely before the maturing and forming of seeds. For obvious reasons the chemical solution should not be applied during or immediately following heavy rainfall. Its effectiveness is also greatly reduced when an application is followed by a heavy rainfall. More than one application a year has not been considered necessary, but to maintain sterility of the soil and effectiveness of the treatment, it is good practice to make an application each year in appropriate strength, as may be required.

While Small and Tender

By G. S. Crites
Division Engineer, Baltimore & Ohio, Punxsutawney, Pa.

Chemical weed killers should be applied while the plants are small and tender and before the seeds have started to form. At such times there is less plant material to cover, and what there is is more susceptible to the chemical, and the seeds are nipped in the bud. Furthermore, the chemicals that might otherwise be used in covering hard, woody fibres and sealed seed pods, may get at the roots of the vegetation, and also sterilize the soil against rapid weed growth.

It will depend in large measure on the time and thoroughness of the first application whether a second and third spraying may be needed to keep the weeds under control. It is false economy and wasted effort to spray chemicals on dry weeds and matured seeds; this should be done while the plants are young and tender.

Has Seen Development

By Engineer Maintenance of Way

I have watched with keen interest the developments that have been made in chemical weed killers and the means for applying them, since the first crude attempts at this form of weed destruction were made. I well remember that, as a youngster in the engineering corps, I was assigned to accompany the first spraying outfit on our road, as it traveled over a branch line having an exceedingly heavy growth of weeds.

The man in charge of the spraying operation did considerable grumbling, first, on the ground that the vegetation was so dense that it required an excessive amount of the chemical—he was being paid by the mile—and, second, because it was so late in the season that many of the plants had already matured. He explained to me that there are two fundamental points to bear in mind when applying liquid weed destroyers. The first is that if the application is made before the plants have attained large size, the growth will be less dense and the

chances of reaching every plant are enhanced; and that, furthermore, the amount of solution needed to insure a satisfactory dosage will be very much reduced.

The second point that he emphasized was that all plants do not mature at the same time; in fact, some of them start to grow much later than others. For this reason, he stated, while it is desirable to make the application before seeds have formed, it is possible in some cases to start applying the chemical too early to catch several varieties of pernicious weeds. On the other hand, too late a start might find some of the early-growing plants so far along that the chemical will not kill the seeds.

I have observed that much of what he said is true. There are not many places where the spread between early and late plants is so great that all species likely to be encountered cannot be killed with a single application of the weed-destroying solution. The greater danger lies in the possibility that the weeds may be allowed to acquire such density that the solution does not reach some of them. His final remark was, "If you kill a plant before it has formed seeds, you will not be bothered with its offspring next year."

What Size of Tie Tamper?

Where track is being raised from 1½ to 3 in. out of face, is it better to use a single tie-tamping outfit or a battery of two or more? Why? What sized (number of tools) outfit or outfits should be used. How many men should be in the gang?

Depends on Kind of Job

By District Engineer

As the question is worded, it may refer to either a small surfacing operation that is being carried out by a section gang or to a large ballasting operation to which a specialized gang with full mechanical equipment is assigned. If the job is that of surfacing a short stretch of track and is being done by an augmented section gang, I would use a four-tool outfit or four unit tampers. If the task is somewhat more ambitious, but still in the hands of the section forces, I would retain the four tools, unless it is a straight surfacing project. If the latter, I would increase the number of unit tampers to eight or assign temporarily an eight-tool electric or pneumatic tamping outfit to the work.

One should always use a great deal of caution when making the assignment of tie tampers, and this is particularly true for small gangs. If the job calls for straight-away surfacing, this is not so much of a problem. On the other hand, if ties are to be renewed, the tamping unit should not have so many tools that the unit engaged in renewing ties cannot keep ahead of it. If the old ballast is to be discarded to the bottom of the ties, the work of the cribbing unit must be synchronized with both the tie-renewal and the tie-tamping units, while the units doing the follow-up work, such as piling old ties, restoring tie plates, replacing anti-creepers and dressing the ballast section, must each be of the right size to keep immediately behind the advance units.

Still thinking in terms of the section gang, unless the amount of surfacing includes enough track to keep the section gang busy for, say, two months, it scarcely pays to increase its size for the purpose of carrying out the project. New men must be educated to do the work required of them, and, if they are laid off in two or three weeks after they have learned to work effectively, the money invested in their education is largely wasted. It is far better to organize a small extra gang for this class of work, for there is ordinarily enough minor surfacing required on a supervisor's district to keep a small extra gang busy throughout the season.

If the work is of sufficient magnitude to require a large gang, that is, if it is a ballast-renewal job, I would assign a pneumatic or an electric tie tamping outfit having 8 to 16 tools. As with the smaller gangs, the work of every unit must be synchronized with all of the others, so that progress will be uniform throughout the gang, and no unit will crowd ahead of the remainder or lag to hold others back. For this reason, the number of tamping tools to be employed will depend in large measure on the number of ties to be renewed; on whether the old ballast is to be discarded or used to make the raise; on how much the maximum as well as the average lift will be; and on other factors. Likewise, the number of men to be employed will depend to a considerable extent on the same factors. For these reasons, it is impossible to say categorically that so many tamping tools will give maximum effectiveness or that a certain number of men will be most advantageous.

I have never seen the advantage of using two tie-tamping outfits with an individual gang. A single outfit can be supervised more easily than two; two units require considerable duplication in the personnel and result in divided responsibility, and this is sometimes detrimental to the quality of the work. On the other hand, if the surfacing is to be carried out simultaneously on two tracks of a multiple track line, there will be less objection to duplication of the tie-tamping equipment, since each track can be made to constitute an independent project, even though a single organization does the work.

If both tracks are to be ballasted, and it is desired to carry the work forward on both tracks at the same time, I prefer to surface one or more miles on one track, then drop back and surface two or more miles on the other, alternating in this way until the work is completed. If, however, traffic is to be diverted from the track that is being raised, I would complete one track to the next station in advance before transferring to the second track. In this way, normally, considerable expense will be avoided in the installation and removal of temporary crossovers.

Favors a Single Outfit

By Supervisor of Track

I am not entirely clear why one would want to use two or more tie-tamping outfits in one gang. I have used as high as four tie-tamping outfits on a single job of surfacing, but I had four gangs in the field, each of which was assigned exactly the same equipment and the same number of men. In this case the advantage of using so many outfits lay in the fact that the job was a large one, aggregating more than 100 miles in a continuous stretch, and we were in a hurry to get the work completed to permit a reduction in train schedules.

We found it necessary to renew considerably more ties than the number that normally would be renewed on such a job, primarily because when we first started to use treated ties on this section of the line, tie renewals were exceptionally heavy for the first two or three years, and the treated ties that were inserted in these years were beginning to fail in rather large numbers. Furthermore, because of the character of the work we were doing we were somewhat more liberal

in making the tie renewals than we would have been in making routine renewals.

These four gangs were operated as independent units, but were kept close together, that is, each gang, as it started out, was assigned to a mile. When that was finished, the gang moved ahead to the second mile post in advance of the leading gang, so that after the first mile was completed, each gang surfaced two miles before moving ahead, except when two gangs moved almost simultaneously, in which case they were spaced only one mile apart.

Among the advantages of this arrangement, the whole operation could be placed in charge of a general foreman, who lost practically no time in supervising the work. The men were in sufficiently close contact to create enough rivalry to stimulate the progress of the gangs. We had a pick-up gang following the main operation, and there was also considerable rivalry as to which gang could put up the track to a standard that minimized the work of the pick-up gang. Keeping the gangs together in this way also minimized the number of slow orders for second and inferior class trains. Our instructions were to allow passenger trains and certain scheduled freight trains to pass at full speed, so that no slow orders were issued, the slowing down of other trains being handled by bulletins issued at such intervals as were necessary to describe the location of the gangs.

I would not work more than one tie-tamping outfit to a gang, for it would call for a useless duplication of personnel, and I can see no advantage in that. Tie tamping equipment is made in such a range of sizes today that one is able to select an outfit that will meet the needs of any gang.

Should Frost Boxes Be Open?

Should the frost box of a water tank be left open or closed during the summer? Of a water column? Why?

Favors the Idea

By V. E. Engman
Chief Carpenter, Chicago, Milwaukee, St. Paul & Pacific, Savanna, Ill.

I believe that it is good practice to open the frost-box doors and roof ventilators on water tanks as soon as freezing weather is over in the spring. They should then be allowed to remain open until the approach of freezing weather in the fall. This will provide an opportunity for the interior of the frost box and the tank roof to dry out thoroughly, and will thus retard decay of the wood. A further advantage of leaving the door to the frost box and the ventilator on the roof open, is that the riser pipes and valves are accessible for inspection at any time during the summer.

Should Be Opened

By Supervisor of Water Service

Frost boxes, no matter how well insulated they may be, gather a great deal of dampness, and in considerable measure this reduces their insulating value. Apparently they will absorb moisture more rapidly during damp weather than they will give it up in dry weather, that is, if they are kept closed. In any event, it has been my observation that a frost box that is kept closed is always damp, and oftentimes it seems to be saturated with moisture.

Obviously, the warm, stagnant air in frost boxes that are kept closed during the summer, combined with this moisture, provide an ideal condition for the growth of decay-producing organisms. Almost every man who has been engaged in repairing water tanks has noted the poorer condition of frost boxes that have always remained closed, compared with those that are allowed to remain open and dry out during warm weather. For these reasons, it is desirable to leave the doors of the frost boxes open during the period when there is no danger of freezing, to permit the maximum circulation of air and thus insure the minimum moisture content of the wood and other insulation.

In mild climates where water-column pits have only a single course of lumber forming the curb, I do not favor leaving the pit uncovered because of the safety hazard and the possibility that the open manhole will attract small boys who may proceed to alter the adjustment of the valves. In any event, under the conditions assumed, covers to these pits are seldom very tight and while much moisture gets into the pit, circulation of the air is fairly satisfactory even when the manhole is closed.

In severe climates, however, where weather-tight heavily insulated pits are constructed, it is desirable to provide maximum ventilation during the warm season. Some water-service officers advocate the removal of the manhole covers from the second and third decks of such pits, but urge that the outside cover be kept in place. I think that we should go all the way in providing ventilation, and I provide frames covered with front - end screening for my water-column pits.

Ventilation Unnecessary

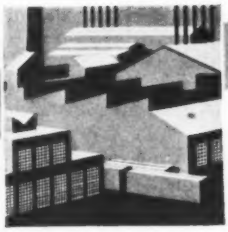
By Water Service Inspector

I am not in favor of leaving the doors open in the frost boxes of water tanks during warm weather. There are a number of reasons why this should not be done. Frost boxes are, as their name implies, intended to prevent the freezing of the riser pipes serving the tanks. To enable them to perform this function satisfactorily, they are generally constructed of alternate layers of dressed and matched boards and tar-saturated roofing material. Since this roofing is, supposedly at least, waterproof, if the frost box has been constructed properly, there should be no chance for moisture to penetrate further than the exposed face of the frost box. Then if this is kept painted, there should be no absorption of moisture by any part of the frost box.

Frost boxes are constructed in alternating layers of wood and roofing, sometimes with one or more layers of insulation. The doors are also constructed in series, that is, several successive doors for each opening. It has been my observation that where such doors are left open during the summer, one or more of them may be missing when the time comes to close them for the winter. Furthermore, valves are sometimes located inside the frost boxes, and if the doors are left open there is always a probability that small boys or irresponsible adults will tamper with them.

All that has been said about frost boxes for water tanks applies with equal force to water-column pits. I have watched this matter for a number of years, and it my observation that frost boxes do not deteriorate rapidly from lack of ventilation.

Covers for water-column pits do sometimes decay with surprising rapidity, but I have never been able to couple this up with lack of ventilation, but with other conditions. It has been our practice to install brick or concrete pits for water colums, with a concrete slab top and metal manhole cover, wherever we have unusual trouble from decay, and, of course, the trouble has disappeared.



Products of Manufacturers

Diesel-Driven Arc-Welder

THE General Electric Company, Schenectady, N. Y., has developed a new single-operator arc-welding set, which consists of a four-cylinder Caterpillar Diesel engine, D-3400, directly coupled to a General Electric 300-amp., Type WD-33-B, d-c generator, which is especially adapted for heavy-duty arc-welding in railway track and structures work. The engine-generator set has only three working adjustments, none of which are on the fuel system, insuring simplicity of operation.

The Caterpillar Diesel power unit is provided with a gasoline engine starter and clutch, which provide easy starting, even in cold weather. Other features of the Diesel engine include a woven fuel-oil filter, force-feed lubrication with a separate oil cooler and two stage filter, special oil-bath air cleaners, an engine-mounted radiator with an automatic thermostat, and an hour meter which indicates when various parts should be lubricated. It is said that the Diesel power unit will burn a wide range of Diesel fuels, with smooth idling, fast pickup, and reliable operation, and that its use saves in the neighborhood of 75 per cent of the fuel costs as compared to other types of internal combustion engines, thus offsetting the greater initial cost of the Diesel power unit if the equipment is used extensively.

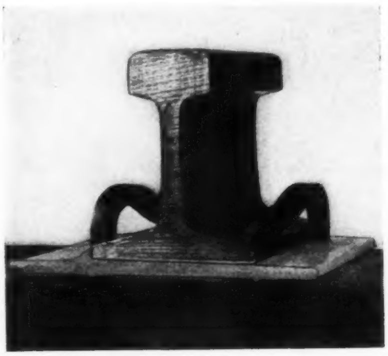
In an effort to increase the efficiency of welding with the new Diesel-powered generator from the standpoint of the time required to make welds and the amount of electrode metal used, the generator is said to provide instant recovery of the voltage to more than 100 per cent of the arc voltage required at any current, and to limit current peaks to 250 to 275 per cent of the steady short-circuit current. These features, it is claimed, permit quick striking and easy maintenance of the arc; prevent time-wasting arc pop-outs, even on vertical welding; and also prevent excessive weld splatter, sluggishness and sticking of the electrode.

The General Electric Single-Operator Arc-Welding Set, Which Consists of a Caterpillar Diesel Engine Coupled to a 300-Amp. General Electric D-C Generator

Elastic Twispike

THE Elastic Rail Spike Corporation, New York, has introduced a variation of its Elastic spike, known as the Twispike, which is designed primarily for use with single-shoulder tie plates, although it may also be used with double-shoulder plates. It is pointed out that, because its toe will not pass the rail head if it is attempted to drive the standard Elastic spike in line holes, this spike cannot be used with single-shoulder tie plates, and it was to remove this limitation to the application of the elastic principle that the Twispike was developed.

In its essential aspects this spike is similar to the standard Elastic spike except for certain differences in the shape of the head. Spikes of both types are made of 5/16-in. by 5/8-in. spring steel, doubled back on itself and formed with an arc or curved head at one end. In the original or standard version, the arc is in the same plane as the shank, and the spike is so driven that the head is at right angles to the rail. Because the toe of this spike would otherwise impinge on the rail head when being driven, special holes for receiving it are punched in the tie plates about 1 3/4 in. from the base of rail.



This Model Shows the Shape of the Twispike and Its Position Relative to the Rail

In the Twispike the head is twisted slightly to one side so that the toe is offset about one inch from the shank, and the spike is so driven that the head extends longitudinally with the rail and the offset end bears against the rail base. In addition, the head is so twisted with respect to itself that the under side of the toe has the same slope as the upper surface of the rail base, thereby giving it a full bearing.

From the foregoing it is apparent that, since the toe of the Twispike extends only one inch onto the base of the rail, this spike can be driven in the line holes of tie plates without impinging on the rail head. Hence, it may be used with single-shoulder tie plates, and when it is used with such plates, the shank of the spike holds the rail to gage in the customary manner. It is pointed out, moreover, that the Twispike is also adapted to use at frogs, switches and other "close" locations where the use of the standard Elastic spike may be limited. When the Twispike is used with double-shoulder tie plates it is pointed out that, since it may be driven through the line holes, the tie plates need not be provided with special holes for this spike.

NEWS of the Month

President Signs Bill Making Train-Wrecking a Federal Crime

President Roosevelt has signed H. R. 8086, a bill sponsored by Representative Walters of Pennsylvania, which makes it a crime to wreck or to attempt to wreck a train engaged in interstate commerce.

Speed Blamed for New York Central Accident

In a report issued on June 13 by the Bureau of Safety of the Interstate Commerce Commission the conclusion was stated that the accident on the New York Central at Little Falls, N. Y., on April 19, 1940, in which 31 persons were killed, was "caused by excessive speed on a sharp curve combined with a run-in of slack resulting from the throttle being closed suddenly."

Ralph Budd Appointed On Council of National Defense

Ralph Budd, president of the Chicago, Burlington & Quincy, has been appointed by President Roosevelt to represent transportation on the Advisory Commission of the Council of National Defense. Mr. Budd will represent the government and cover all transport needs by rail, water and motor carrier. In his assignment he will work closely with the Association of American Railroads, and the A. A. R. has promised full co-operation.

House Overrides Veto of Bridge Bill

On June 19 the House of Representatives voted 324 to 68 to pass over the President's veto, H. R. 9381, a bill providing relief for railroads with respect to the cost of rebuilding bridges in connection with waterway projects. The bill was vetoed by President Roosevelt on June 10, who asserted that, "It does not appear that any adequate reason exists for imposing upon the federal government the additional burdens the bill proposes."

Dr. W. M. Barr Elected President of A. S. T. M.

At the annual meeting of the American Society for Testing Materials, held at Atlantic City, N. J., June 24-28, Dr. W. M. Barr, chief chemical and metallurgical engineer of the Union Pacific, was elected president of the Society for the ensuing year. Dr. Barr, who has charge of all laboratories, water supply, inspection and tests of materials, and specifications for materials on the Union Pacific, has been active in the work of the A. S. T. M. for many years, having served as a chairman and member of many of its committees, as a member of its Executive committee from 1934 to 1936, and as vice-president from 1938 to 1940.

Santa Fe Completes Second Main Track to Coast

Twenty-three miles of newly constructed second main track between Joseph City, Ariz., and Double Track Junction were placed in service on June 1 by the Atchison, Topeka & Santa Fe, completing the last link of two main tracks for this road from Chicago to the Pacific Coast. Double tracking of the Santa Fe main line was begun in 1897 from Florence, Kan., to Cedar Point. The newly completed link was laid with 131-lb. rail and 9-ft. ties, and involved the construction of two steel bridges, one 300 ft. long and the other 240-ft. long.

Vacations with Pay Demand Countered with Wage Reduction

On May 25, the Western railroads announced their intention of filing a 30-day notice of a 10 per cent reduction in all existing rates of pay for the members of 14 non-operating brotherhoods, unless the demand of these brotherhoods for an annual two-weeks vacation for their members with pay was withdrawn. Concerning the vacations with pay, the Western roads replied to the chairmen of the brotherhoods affected that "this in effect is a proposal for an increase in compensation which we consider is without justification and particularly inopportune at the present time."

Crossing Accidents Decrease in 1939

In 1939 fatalities resulting from highway-railroad grade crossing accidents totaled 1,398, fewer than any year since 1915. This record was established despite an increase in train-miles and in the volume of automobile traffic, the latter being indicated by an increase in gasoline consumption. In 1938, the total number of such fatalities was 1,517. The total number of persons injured in highway-railroad grade crossing accidents in 1939 was 3,999, compared to 4,018 in 1938. For the first two months of 1940, however, railroad grade crossing accidents have shown an increase compared with the same period in 1939.

Harriman Safety Awards

The South-Central district of the Union Pacific was the winner in Group A (operating ten million or more locomotive miles a year) of the gold E. H. Harriman Memorial Medal for the year 1939. The Chicago, St. Paul, Minneapolis & Omaha won the silver medal in Group B (one to ten million locomotive miles a year), and the Charleston & Western Carolina was the winner of the bronze medal in Group C (less than one million locomotive miles a year). Since the founding of the E. H. Harriman Memorial awards in 1913, the Union Pacific, or one of its component roads, has won 8 gold medals out of 20 awards. The medals were presented at a luncheon on June 20 given by the American Museum of Safety at the Yale club, New York. A special safety award was made to the New York Central System for having operated more than 16 consecutive years, with a total of 50,463,685,000 passenger miles, without a passenger fatality in a train accident.

Seventy-Fifth Anniversary First Steel Rail Made in U. S.

The seventy-fifth anniversary of the rolling of the first steel rail in the United States on May 24, 1865, was commemorated at a special luncheon meeting of the Traffic Club of Chicago on June 10. The first steel rail was rolled at Captain E. B. Ward's Chicago Rolling Mill on the North branch of the Chicago river, which became the nucleus for the North Chicago Rolling Mill Company, and later a component of the Illinois Steel Company, one of several companies combined subsequently to form the United States Steel Corporation. Ralph Budd, president of the Chicago, Burlington & Quincy, in addressing the commemoratory meeting, discussed the evolution of railroad rails from the standpoint of the railroads, while Clarence Randall, vice-president of the Inland Steel Company, spoke on the contributions of the steel industry to the progress that has been made in the development of rail. Motion pictures were shown contrasting early and modern rail production methods.

Personal Mention

General

D. B. Jenks, trainmaster and division engineer on the Klamath division of the Great Northern, with headquarters at Klamath Falls, Ore., has been appointed trainmaster, with headquarters at Hillyard, Wash.

James L. Cranwell, division engineer of the Eastern division of the Pennsylvania, with headquarters at Pittsburgh, Pa., has been promoted to superintendent of the Monongahela division, with the same headquarters.

J. A. Russell, manager of water service on the Pennsylvania, has been promoted to general real estate agent, with headquarters at Philadelphia, Pa., with jurisdiction over the entire system. Mr. Russell, a native of Philadelphia, graduated from Brown Preparatory School, and later from the University of Pennsylvania, where he received the degree of Bachelor of Science in Civil Engineering in 1913. While pursuing his studies, he engaged in railroad work during summer vacations. In June, 1913, he entered the service of the Pennsylvania's water companies as assistant engineer, and in 1916, resigned to become an instructor in hydraulics, water supply and sewerage in the Civil Engineering department at the University of Pennsylvania, returning to the service of the water companies in 1917. Later in 1917, Mr. Russell was commissioned a second lieutenant in the Engineer Corps of the United States Army, and assigned as an assistant to the chief engineer, 86th division. He became first lieutenant in 1918, and shortly afterwards was promoted to the command of Company B, 311th Engineers, serving with that unit until the close of military service in July, 1919, following which he returned to his railroad work with the water companies. In 1924, he withdrew to engage in private civil engineering practice, and in 1925 re-entered the service of the water companies, becoming engineer of water service in 1929, and manager of water service, January 1, 1932.

J. A. Russell

W. C. Hurst, senior vice-president of the Chicago & Illinois Midland, and an engineer by training and experience, has been elected president, with headquarters as before at Springfield, Ill. Mr. Hurst was born at Durham, England, on June 27, 1877, and entered railway service in April, 1890, as a water boy on the Chicago, Burlington & Quincy in Missouri. He later served successively as a track laborer, yard clerk, rodman, assistant engineer, resident engineer on construction and engineer of construction. In July, 1903, he went with the Missouri Pacific as assistant superintendent at Chester, Ill. Two years later he went with the Ann Arbor and the Detroit, Toledo & Ironton, assigned to special work in the general manager's office and four months later he was appointed superintendent at Springfield, Ohio. Mr. Hurst later served as a trainmaster and chief clerk to the president and general manager of the Pere Marquette, superintendent on the Cincinnati, Hamilton & Dayton (now part of the Baltimore & Ohio) at Dayton, Ohio, general superintendent of the Chicago, Peoria & St. Louis, and general superintendent of the Eastern district of the Pere Marquette, with headquarters at Saginaw, Mich. On January 1, 1914, he was appointed vice-president and general manager of the Chicago, Peoria & St. Louis, with headquarters at Springfield, Ill. In 1926, the C. P. & St. L. was split up under reorganization, the northern half being assigned to the Springfield, Havana & Peoria, which, in turn, was leased to the Chicago & Illinois Midland, and Mr. Hurst was appointed senior vice-president of the C. & I. M., the position he held until his recent promotion.

W. C. Hurst

Leonard B. Allen, assistant to the executive vice-president of the Chesapeake & Ohio lines, including the Nickel Plate and the Pere Marquette, with headquarters at Cleveland, Ohio, and an engineer by training and experience, has been promoted to assistant to the president of the Chesapeake & Ohio lines, with the same headquarters. Mr. Allen was born at Lexington, Ky., on April 19, 1879, and was graduated in civil engineering from Kentucky State University in 1899. He entered railway service in that year as a rodman on the Southern, and in August, 1899, he went with the C. & O. as a levelman on the location of the Big Sandy division. He served on location and construction work until January 1, 1904, when he was promoted to assistant in the office of the engineer maintenance of way at Richmond, Va., and a year later he was advanced to division engineer of the Kentucky division, with headquarters at Ashland, Ky. Mr. Allen was promoted to engineer maintenance of way of the Kentucky general division, with headquarters at Covington, Ky., on May 1, 1910, and on January 1, 1914, he was further advanced to assistant chief engineer, with headquarters at Richmond. One month later he was appointed superintendent of the Huntington and Big Sandy divisions, with headquarters at Huntington, W. Va., and on July 1, 1916, he was promoted to general superintendent of the Western general division, with the same headquarters. On January 29, 1918, Mr. Allen was advanced to superintendent of maintenance of way for the entire system, with headquarters as before at Huntington, and in October, 1926, he was promoted to assistant to the vice-president, with headquarters at Richmond. Early in 1933, Mr. Allen was appointed assistant to the executive vice-president of the C. & O. and the Nickel Plate, and later also of the Pere Marquette, with headquarters at Cleveland, the position he held until his recent promotion.

Leonard B. Allen

Engineering

W. A. Blackwell has been appointed assistant engineer maintenance of way of the Western Maryland, with headquarters at Baltimore, Md., a newly created position.

V. B. Elliott, construction engineer of the Clinchfield Railroad, with headquarters at Erwin, Tenn., has been appointed chief engineer, with the same headquarters, a change in title.

W. A. Gunderson, district maintenance engineer on the Chicago, Rock Island & Pacific, with headquarters at Kansas City, Mo., has been transferred to El Reno, Okla., replacing **C. H. Hardwick,** who, in turn, has been transferred to Kansas City, relieving Mr. Gunderson.

R. R. Manion has been appointed trainmaster and division engineer on the Klamath division of the Great Northern, with headquarters at Klamath Falls, Ore., suc-

ceeding **D. B. Jenks,** whose appointment as trainmaster at Hillyard, Wash., is announced elsewhere in these columns.

Richard R. Metheany, engineer, maintenance of way of the Central Pennsylvania division of the Pennsylvania, with headquarters at Williamsport, Pa., has been promoted to assistant to the chief engineer, maintenance of way, Eastern region, with headquarters at Philadelphia, Pa., a newly created position, and **C. W. Van Nort,** superintendent of the Williamsport division, has been advanced to engineer, maintenance of way of the Central Pennsylvania division succeeding Mr. Metheany.

C. E. Herth, assistant engineer in the office of the engineer maintenance of way of the Baltimore & Ohio, with headquarters at Cincinnati, Ohio, has been promoted to assistant division engineer at Dayton, Ohio, to succeed **E. H. Barnhart,** whose appointment as general bridge inspector at Cincinnati is noted elsewhere in these columns. **H. A. Bennett,** assistant on the engineering corps at Cincinnati, has been appointed assistant engineer at the same point to succeed Mr. Herth.

Ralph E. Knapp, whose promotion to division engineer on the Atchison, Topeka & Santa Fe, with headquarters at Las Vegas, N. M., was announced in the June issue, was born in Arkansas on September 1, 1901, and entered railway service in October, 1916, as a chainman on the Sante Fe. A short time later he was promoted to rodman, and in May, 1922, he was advanced to transitman. In March, 1936, he was appointed assistant engineer on construction at Amarillo, Tex., and on July 1, 1937, he was promoted to roadmaster, with headquarters at Albuquerque, N. M. Mr. Knapp was transferred to La Junta, Colo., in December, 1937, and on January 1, 1940, he was appointed acting division engineer at Las Vegas. His promotion to division engineer was effective May 1.

W. J. Turner, senior assistant engineer in the office of the engineer maintenance of way of the Atlantic Coast Line at Jacksonville, Fla., has been appointed division engineer maintenance of way, with the same headquarters, succeeding **H. L. Slemp,** whose appointment as roadmaster is noted elsewhere in these columns. **D. M. Lamdin, Jr.,** assistant engineer at Jacksonville, has been appointed office engineer to replace **Columbus E. Vick,** who has become senior assistant engineer to replace Mr. Turner. **O. B. Saunders** has been appointed junior engineer at Jacksonville to relieve **W. E. Free,** who has become assistant engineer to succeed Mr. Lamdin.

Mr. Vick was born on June 25, 1901, and is a native of Nashville, N. C. He obtained his higher education at North Carolina State college and entered railway service on June 11, 1925, as a rodman on the Atlantic Coast Line. In September of the same year he was advanced to transitman and in April, 1929, he became junior engineer. In August of the following year, Mr. Vick was made assistant engineer and in June, 1939, he was promoted to office engineer, which position he was holding at the time of his recent appointment as senior assistant engineer.

Ralph H. Pinkham, engineer, maintenance of way of the Southwestern general division of the Pennsylvania, with headquarters at Indianapolis, Ind., has been promoted to assistant to the chief engineer, maintenance of way of the Western region, with headquarters at Chicago, a newly created position. **Charles G. Grove,** superintendent of the Pan Handle division, with headquarters at Pittsburgh, Pa., has been advanced to engineer, maintenance of way of the Southwestern general division, with headquarters at Indianapolis, succeeding Mr. Pinkham.

Mr. Pinkham was born on January 16, 1880, at Nashua, N. H., and graduated from the Massachusetts Institute of Technology in June, 1899. In the same month, he entered railway service as a draftsman in the maintenance of way department of the general office of the Pennsylvania at Philadelphia, Pa. He resigned in May, 1901, but returned to the Pennsylvania three months later. Mr. Pinkham was advanced to assistant supervisor of the Middle division in 1902, became supervisor of the West Jersey & Seashore Railroad in 1905, and was transferred to the Pittsburgh division in 1912. He was promoted to division engineer of the Renovo division, with headquarters at Erie, Pa., in October, 1915, was advanced to assistant superintendent of the Pittsburgh division on February 1, 1918, and, seven months later, was promoted to superintendent of the Norfolk division, with

Ralph H. Pinkham

headquarters at Cape Charles, Va. He was transferred to the Fort Wayne division on July 1, 1922, and was advanced to engineer, maintenance of way, of the Southwestern general division on May 16, 1928.

Mr. Grove was born in York County, Pa., in December, 1890, and graduated from Pennsylvania college in 1912. In June of that year he entered the service of the Pennsylvania as a rodman at Philadelphia. He also served in various capacities in the maintenance of way department prior to his advancement in 1917 to assistant supervisor at Philadelphia. He later served in that capacity on the Allegheny and Pittsburgh divisions. Mr. Grove was promoted to supervisor of track in 1920 and served on the Monongahela, Western Pennsylvania, Pittsburgh, Buffalo and Eastern Ohio divisions prior to his advancement to division engineer of the St. Louis division on November 16, 1928. Five years later he was transferred to the Pan Handle division, with headquarters at Pittsburgh, and was promoted to superintendent of the Wilkes-Barre division on July 1, 1933. He was made superintendent of passenger transportation, Eastern region, with headquarters at Philadelphia, on October 1, 1934; was made superintendent of the Williamsport

Charles G. Grove

division on May 1, 1936, and became superintendent of the Pan Handle division on February 1, 1937, the position he held until his recent promotion, which was effective June 16.

Russell L. Sahm, assistant supervisor of track on the Eastern division of the New York Central, with headquarters at Beacon, N. Y., has been promoted to assistant division engineer of the Pennsylvania division, with headquarters at Jersey Shore, Pa., to succeed **William J. Kernan,** whose appointment as supervisor of track is noted elsewhere in these columns. **Fred H. Holloway,** assistant supervisor of track of Subdivision 5 of the Mohawk division, with headquarters at Albany, N. Y., has been promoted to assistant division engineer of the River division at Weehawken, N. J., succeeding **C. E. Chase,** who has retired.

Mr. Sahm was born on October 20, 1900, at New Millport, Pa., and was graduated from Gettysburg college in 1922. On June 22 of the same year, he entered the service of the New York Central, serving in various positions on the engineering corps at Jersey Shore, New York City and Buffalo, N. Y., until August 16, 1930. On that date Mr. Sahm was promoted to assistant supervisor of track, with headquarters at Lackawanna, N. Y. Later he was transferred successively to Jersey Shore, Newburgh, N. Y., and Beacon. He was serving at the latter location at the time of his recent promotion to assistant division engineer.

Mr. Holloway has been in the service of the New York Central for nearly 23 years. He was born on November 16, 1892, at Gunnison, Colo., and attended the College of Engineering at the University of Michigan, graduating in 1917. He entered the service of the New York Central on September 16, 1917, as a member of the engineering corps of the Rochester

division. On December 15, 1925, he was promoted to assistant supervisor of track of the Adirondack division, being transferred to the Mohawk division on April 16, 1929, where he remained until his recent promotion.

Track

O. A. Melton, acting roadmaster on the Missouri-Kansas-Texas at Wichita Falls, Tex., has been promoted to roadmaster, with the same headquarters.

John W. Weaver, track supervisor on the Erie, at Marion, Ohio, has been transferred to Kent, Ohio, succeeding **F. W. Holland,** who, in turn, has been transferred to Marion.

J. S. Anthony, a student apprentice on the Southern, has been promoted to track supervisor, with headquarters at Oxford, N. C., to succeed **J. D. Leonard,** retired.

J. H. Campbell, section foreman on the Canadian National at Golden Lake, Ont., has been appointed acting roadmaster of the Renfrew and Locksley subdivisions of the Ottawa division, to succeed **W. H. Townson,** who has retired.

S. B. Hinton, Jr., assistant trainmaster on the Southern, has been appointed track supervisor in charge of the Birmingham Terminals, with headquarters at Birmingham, Ala., succeeding **L. B. Craig,** whose promotion to supervisor of bridges and buildings, with headquarters at Louisville, Ky., is announced elsewhere in these columns.

S. T. Montgomery, assistant supervisor of track on the Southern at Birmingham, Ala., has been promoted to supervisor of track, with headquarters at Huntingburg, Ind., succeeding **J. B. Singleton,** whose appointment as assistant supervisor of bridges and buildings, with headquarters at Birmingham, is announced elsewhere in these columns. **E. M. Pelter,** assistant to roadmaster at Somerset, Ky., has been advanced to assistant supervisor of track at Birmingham.

Glenn E. Armstrong, whose promotion to roadmaster on the Sterling division of the Chicago, Burlington & Quincy, with headquarters at Curtis, Neb., was announced in the June issue, was born at Alvo, Neb., on October 8, 1893, and entered railway service on February 16, 1924, as a section laborer on the Omaha division of the Burlington. On April 16, 1926, he was promoted to section foreman and served as a section foreman and extra gang foreman until July 16, 1937, at which time he was promoted to track supervisor on the Wymore division. On January 1, 1939, Mr. Armstrong was transferred to the Lincoln division, where he was located until his recent promotion.

H. M. Richardson has been appointed roadmaster on the Southern Pacific, with headquarters at Dallas, Ore., succeeding **Charles McCann,** who retired on April 30.

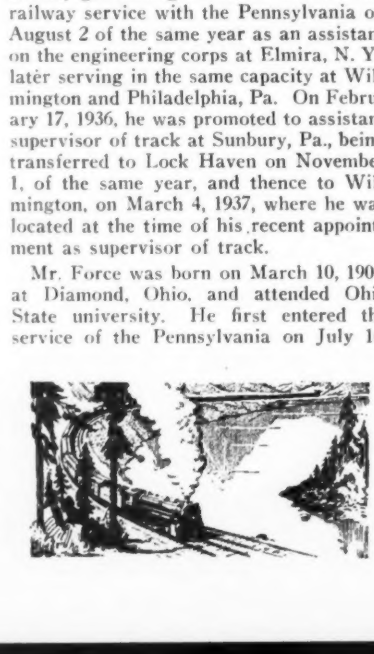
Mr. McCann was born at Clackamas, Ore., on April 23, 1870, and entered railway service on June 2, 1890, as a section laborer at Milwaukie, Ore., on the Oregon & California (now part of the Southern Pacific). The following year he was promoted to section foreman, and in 1908, during the period in which the Oregon-Washington Railroad & Navigation Company (now part of the Union Pacific) and the Southern Pacific were under the same management, he was promoted to roadmaster at La Grande, Ore. In 1912, he was transferred to the Hillsboro district, and the following year he was transferred to Dallas, where he remained until his retirement.

Ralph B. Grier, assistant cost engineer on the Chesapeake & Ohio, who has been promoted to supervisor of track, with headquarters at Raleigh, W. Va., as reported in the June issue, has been identified with the C. & O. continuously for more than 17 years. He was born on December 24, 1903, at Pineville, N. C., and attended night school at the University of Cincinnati. He entered railway service with the C. & O. on February 17, 1923, as a rodman in the engineering department. In March, 1924, he became a material accountant, and in April, 1925, he was appointed an instrumentman, becoming a masonry inspector in October of the same year. In March, 1926, Mr. Grier was transferred to the maintenance of way department as assistant cost engineer, holding this position until the time of his recent appointment as supervisor of track.

William T. Rice, assistant supervisor of track on the Pennsylvania, with headquarters at Wilmington, Del., has been promoted to supervisor of track at Wheeling, W. Va., to succeed **A. M. Kennedy,** who has been transferred to Buffalo, N. Y. Mr. Kennedy succeeds **G. D. Markert,** who has been transferred to Carnegie, Pa., where he succeeds **W. P. Geiser,** who has been transferred to Olean, N. Y. **David W. Force,** assistant supervisor of track at Coshocton, Ohio, has been promoted to supervisor of track at Harrington, Del. **H. W. Seeley,** assistant supervisor of track at Lock Haven, Pa., has been transferred to Coshocton to replace Mr. Force.

Mr. Rice was born on June 13, 1912, at Hague, Va., and was educated in civil engineering at Virginia Polytechnic Institute, graduating in 1934. He entered railway service with the Pennsylvania on August 2 of the same year as an assistant on the engineering corps at Elmira, N. Y., later serving in the same capacity at Wilmington and Philadelphia, Pa. On February 17, 1936, he was promoted to assistant supervisor of track at Sunbury, Pa., being transferred to Lock Haven on November 1, of the same year, and thence to Wilmington, on March 4, 1937, where he was located at the time of his recent appointment as supervisor of track.

Mr. Force was born on March 10, 1909, at Diamond, Ohio, and attended Ohio State university. He first entered the service of the Pennsylvania on July 16,



1934, as an assistant on the engineering corps of the St. Louis division at Terre Haute, Ind. On November 1, 1935, he was transferred to the New York division at New York, N. Y., being promoted to assistant supervisor of track on the Philadelphia division at Harrisburg, Pa., on April 15, 1936. On October 10 of the same year, he was transferred to the Pan Handle division, where he was located at the time of his promotion to supervisor of track at Harrington.

William J. Kernan, assistant division engineer of the Pennsylvania division of the New York Central, with headquarters at Jersey Shore, Pa., has been promoted to supervisor of track of Subdivision 26 of that division, with the same headquarters, to succeed **F. H. Egan,** who has been transferred to Subdivision 14 of the Buffalo division, with headquarters at Lackawanna, N. Y., replacing **J. P. Sexton,** who has retired. **C. J. Randall,** a member of the engineering corps at New York, has been promoted to assistant supervisor of track of Subdivision 20 of the River division, with headquarters at Newburgh, N. Y., to replace **H. B. Rutherford,** who has been transferred to Subdivision 3 of the Eastern division at Beacon, to relieve **Russell L. Sahm,** whose appointment as assistant division engineer is noted elsewhere in these columns. **J. R. Watt, Jr.,** a transitman on the engineering corps at Albany, has been promoted to assistant supervisor of track at that point to succeed **Fred H. Holloway,** whose appointment as assistant division engineer is also reported elsewhere.

Mr. Kernan has been in the service of the New York Central for nearly 23 years. He was born on November 24, 1896, at Albany, N. Y., and attended Rensselaer Polytechnic Institute. He began his railway career on the New York Central on October 1, 1917, as a chainman on the Mohawk division at Albany, N. Y. Until April, 1929, he held at various times the positions of chainman, rodman, draftsman, transitman and bridge inspector, being located for practically all of this time at Albany. On April 1, 1929, he was advanced to assistant engineer on the Rochester division at Rochester, N. Y., and on October 20, 1931, he became assistant supervisor of track on the Syracuse division at Canandaigua, N. Y. He remained at the latter point until April 1, 1935, when he was transferred to the Mohawk division at Fonda, N. Y. Subsequently, Mr. Kernan was advanced to assistant division engineer at Jersey Shore, where he remained until his recent promotion to supervisor of track.

Frank L. Etchison, roadmaster on the Atlantic Coast Line, with headquarters at Charleston, S. C., has been promoted to general roadmaster, with headquarters at Rocky Mount, N. C., with supervision over the Northern district of the Northern division. **F. C. Chandler,** roadmaster at Tampa, Fla., has been promoted to general roadmaster of the Southern district of the Southern division with headquarters at Lakeland, Fla. The position of general roadmaster at Lakeland has been vacant since the retirement of **B. E. Haley** early in 1939. **Halsie H. Hill,** a

section foreman, has been promoted to roadmaster at Charleston, to succeed Mr. Etchison, while **W. F. Corley,** roadmaster at Lakeland, has been transferred to Tampa to succeed Mr. Chandler. **H. L. Slemp,** division engineer maintenance of way at Jacksonville, Fla., has been appointed roadmaster at Lakeland to replace Mr. Corley.

Mr. Etchison was born on February 27, 1902, at Baltimore, Md. He attended George Washington university for three years and also pursued a course of study through the International Correspondence Schools. He entered railway service in the summer of 1921, as a trackman on the Baltimore & Ohio at Gaithersburg, Md., working each summer in this capacity until 1923, when he became relief foreman and clerk to the supervisor at Gaithersburg. On April 8, 1924, Mr. Etchison entered the service of the Atlantic Coast Line as a rodman in the construction department at Ludowici, Ga., later being advanced to instrumentman at the same point. In August of the following year, he went with the Charleston & Western Carolina in the same capacity, with headquarters at Spartonburg, S. C., returning to the A. C. L. in June, 1926, as a resident engineer at Monticello, Fla. Later he served in the same capacity at Perry, Fla., and Orlando. In November, 1927, he entered the maintenance of way department as a roadmaster at Live Oak, Fla., later being transferred to Charleston, where he was located at the time of his recent promotion to general roadmaster.

Mr. Hill was born on January 22, 1905, near Walterboro, S. C., and entered railway service on April 3, 1926, as an apprentice foreman in the maintenance of way department of the Atlantic Coast Line. On November 3 of the same year, he was advanced to section foreman, with headquarters at Burroughs, Ga., being further promoted to extra gang foreman on January 21, 1930. On October 17, 1932, Mr. Hill returned to the position of section foreman, holding this position successively at Cades, S. C., Lanes and Jacksonboro, South Carolina.

Bridge and Building

E. H. Barnhart, assistant division engineer on the Baltimore & Ohio, with headquarters at Dayton, Ohio, has been appointed general bridge inspector, with headquarters at Cincinnati, Ohio, to succeed **A. B. Scowden,** deceased.

L. B. Craig, track supervisor on the Southern at Birmingham, Ala., has been promoted to supervisor of bridges and buildings, with headquarters at Louisville, Ky., succeeding **J. R. Kelly,** who has been transferred to the territory formerly under the jurisdiction of **E. H. Nutt,** with headquarters as before at Louisville.

H. L. Veith, assistant supervisor of bridges and buildings on the Southern, with headquarters at Birmingham, Ala., has been promoted to supervisor of bridges and buildings with headquarters at Wilton, Ala., succeeding **A. C. Jones,** who has been transferred to Parrish, Ala., replacing **J. H. Johnson,** who retired on June 24, because of ill health. **J. B. Singleton,** supervisor of track at Huntingburg, Ind., has been appointed assistant supervisor of bridges and buildings at Birmingham, relieving Mr. Veith.

Water Service

H. E. Peterson has been appointed water and fuel supervisor on the Southern Pacific at West Oakland, Cal., succeeding **J. J. Murphy,** who has retired.

Special

Richard E. Sampson, who has been appointed supervisor of welding of the Boston & Maine, with headquarters at Boston, Mass., as announced in the June issue, was born on January 17, 1906, at Concord, N. H. Mr. Sampson received his higher education at Tufts college, graduating in 1928 with a Bachelor of Science degree in chemical engineering. He entered railway service in June, 1926, as a chainman on the Boston & Maine. Two years later he was promoted to rodman, and after a month in this capacity, he was advanced to general welding foreman. He was holding the latter position at the time of his appointment as supervisor of welding.

Obituary

L. J. Reiser, assistant supervisor tie and timber department of the Chicago, Rock Island & Pacific, with headquarters at Kansas City, Mo., died suddenly at that point on June 5.

Charles Finley Ford, supervisor tie and timber of the Chicago, Rock Island & Pacific, with headquarters at Chicago, died suddenly on a train en route from Kansas City, Mo., to Chicago, on June 9. Mr. Ford was born in Christian county, Ill., on December 17, 1869, and entered railway service during the summer of 1886, as a water boy on the Rock Island, at Cameron, Mo. During the summer of 1887, he worked on a work train, and on November 1, 1887, he was appointed roadmaster's clerk at Cameron. On January 1, 1898, he was transferred to Davenport, Iowa, and two years later he was promoted to chief clerk at that point. Mr. Ford was transferred to Chicago on June 1, 1902, and served as chief clerk and assistant chief clerk until November 11, 1907, when he was promoted to assistant to the engineer maintenance of way. On February 7, 1908, he was appointed supervisor tie and timber, the position he held until his death.

Charles D. Purdon, former chief engineer of the St. Louis-Southwestern, who retired on January 1, 1930, as consulting and valuation engineer of that road, with headquarters at St. Louis, Mo., died at his home in Paris, Tex., on June 3. Mr. Purdon was born in Ireland on October 6, 1850, and graduated from Queens university in Ireland. He entered railway service in 1870 as an axman on the Intercolonial (now part of the Canadian National). He was in charge of the location and construction of many miles of road in

Charles D. Purdon

the United States, and supervised the construction of several large bridges. Mr. Purdon also held important positions in the engineering department of several roads, having been assistant chief engineer in charge of branch line construction of the Louisville & Nashville; assistant chief engineer of the Atchison, Topeka & Santa Fe; chief engineer of the Kansas City Belt (now part of the Kansas City Terminal); chief engineer of the St. Louis-San Francisco; chief engineer of the Memphis Terminal (now part of the Illinois Central), and assistant engineer on the Missouri Pacific in charge of valuation of the Nebraska lines and grade separation at St. Louis. In 1910, Mr. Purdon was appointed chief engineer of the Cotton Belt, being made consulting and valuation engineer in 1918.

George Gibbs, consulting engineer of the Pennsylvania and chief engineer of electric traction of the Long Island, with headquarters at New York, died at the Presbyterian hospital in that city on May 19, after a long illness. Mr. Gibbs was born on April 19, 1861, at Chicago. He was graduated from the Stevens Institute of Technology in 1882, receiving the degree of mechanical engineer, and in 1931 he was awarded the degree of doctor of engineering. He entered railway service in 1884 as engineer of tests and chemist on the Chicago, Milwaukee & St. Paul (now Chicago, Milwaukee, St. Paul & Pacific). In 1888, he became mechanical engineer of that road, and also the Milwaukee & Northern (now C. M. St. P. & P.). Mr. Gibbs was later consulting engineer, jointly, of the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company, engaged in the development of electric locomotives, and on electric traction projects in Europe. He later served in various consulting engineering capacities in the vicinity of New York, and in 1910 organized the consulting engineering firm of Gibbs & Hill, specializing in heavy traction design and

construction. From 1912 to 1928, he was consulting engineer to the Public Service Commission of the first district of the State of New York. Up to the time of his death, he was identified as consulting engineer to the New York, New Haven & Hartford; the Delaware, Lackawanna & Western; the Great Eastern; the London & Southeastern; the London, Brighton & South Coast; and the South Eastern & Chatham (England). He was a member and past president of the American Institute of Consulting Engineers. In 1919 Mr. Gibbs served as chairman of the Electrical section of the A. R. A. (now the Association of American Railroads).

John V. Neubert, chief engineer maintenance of way of the New York Central System, with headquarters at New York, died on June 4 following a long illness. Mr. Neubert had been identified with the New York Central continuously for nearly 41 years. He was born on July 18, 1876, at Kittanning, Pa., and was graduated from Pennsylvania State college in 1899. He entered railway service with the New York Central & Hudson River (now the New York Central) on July 3, 1899, as a

John V. Neubert

clerk. In the following month he was transferred to the engineering department where he served as chainman, rodman and inspector until September, 1900, when he was advanced to assistant supervisor of track. In May, 1902, Mr. Neubert was promoted to supervisor of track and in January, 1903, he became assistant engineer in the office of the division engineer at Albany, N. Y. Four years later Mr. Neubert was advanced to division engineer at Albany, being further promoted to engineer of track, Lines East of Buffalo, exterior zone, in April, 1909. In July, 1920, he became engineer maintenance of way of the same territory, with headquarters at New York. Seven years later, Mr. Neubert was promoted to chief engineer maintenance of way of the New York Central, including the Lines East and West of Buffalo and the Ohio Central Lines, with headquarters as before at New York. In 1931, his jurisdiction was extended over the Cleveland, Cincinnati, Chicago & St. Louis and the Michigan Central. Mr. Neubert had been active in the affairs of a number of railroad associations, including the American Railway Engineering Association, of which he served as president in 1932-33.

Association News

Wood-Preservers' Association

At a recent meeting of the Executive committee held in Washington, D. C., a new standing committee on Gum Ties and Lumber—Pressure Treatment, was created, this committee to be charged with the development and preparation of a specification for the treatment of gum ties and lumber. It is expected that the 1940 Proceedings of the Association, now in the hands of the printer, will be mailed to the membership during July.

Roadmasters Association

The Executive committee of the Association, presided over by G. L. Sitton, president, met in Chicago on June 8 with chairmen of the various technical committees, and reviewed in detail, prior to their final completion, the reports to be presented before the convention in Chicago, September 10-12. Among other business transacted by the committee was the consideration of proposed changes in the constitution of the Association, and the election of F. O. Whiteman, secretary, to fill the unexpired term in this office occasioned by the death of C. A. Lichty on April 18. Mr. Whiteman, formerly superintendent of the East St. Louis & Suburban, and since 1929 secretary and treasurer of the American Association of Railroad Superintendents, was also, on June 8, elected secretary and treasurer of the American Railway Bridge and Building Association.

Track Supply Association

Forty-nine companies, manufacturing and selling equipment and materials of interest to the maintenance of way departments of the railways have already arranged to display their products at the annual exhibit of the association, to be held in the Hotel Stevens, Chicago, September 9-12, in conjunction with the annual convention of the Roadmasters' and Maintenance of Way Association, auguring one of the most successful exhibits to be held in recent years. This number of companies includes four which made applications for space during the last month, adding to the list of 45 companies published in the June issue. The additional companies include:

Armco Railroad Sales Company, Middletown, O.
Conley Frog & Switch Company, Memphis, Tenn.
Hayes Track Appliance Company, Richmond, Ind.
Oliver Iron & Steel Company, Pittsburgh, Pa.

Bridge and Building Association

President A. E. Bechtelheimer has called a meeting of the Executive committee in Chicago on July 15, at which time, in addition to taking up other business preparatory to the convention, to be held in Chicago, October 15-17, the chairmen of the various technical committees will present their reports for review prior to presentation before the convention.

At a meeting of the Executive committee on June 8, F. O. Whiteman, secretary and treasurer of the American Association of Railroad Superintendents, was elected secretary of the Association, and F. E. Weise, chief clerk, engineering department, Chicago, Milwaukee, St. Paul & Pacific, was elected treasurer, to fill out the unexpired term of these offices left vacant by the death of C. A. Lichty. A memorial Bulletin to Mr. Lichty has been prepared and is in the hands of the printer, and will be mailed to the membership early in July.

American Railway Engineering Association

Eleven committees of the association held meetings during June, including those on Stresses in Track, at Chicago, June 4; Roadway and Ballast, at Ashland, Ky., on June 6 and 7; Track, at Chicago on June 6; Wood Bridges, at Chicago on June 6; Rules and Organization, at New York on June 7; Yards and Terminals at Pittsburgh, Pa., on June 17; Ties (an inspection trip to Ironton, Mo., Little Rock, Ark., and Texarkana, Ark.), on June 19 and 20; Economics of Railway Location and Operation, at Cleveland, Ohio, June 20 and 21; Buildings, at New York, June 25 and 26; Highways, at Chicago, June 26; and Water Service at Chicago, June 27. Only one committee has as yet scheduled a meeting for July, this being the committee on Maintenance of Way Work Equipment, at Cleveland, on July 22 and 23.

Work on the 1940 Proceedings has been completed and this volume will be mailed to the members of the association on, or shortly after, July 1.

The amendment to the Constitution providing for Junior memberships in the association was adopted by letter ballot, with only eight dissenting votes, and became effective on June 7. This amendment provides for membership of railway engineering employees between the ages of 21 and 30 years who have had three or more years railway experience or who have graduated in engineering schools of recognized standing. The provisions for junior memberships provide for remitting the entrance fee, and annual dues of $5.00.

Supply Trade News

General

The Julian d'Este Company, Boston, Mass., has been merged with the **American Chain & Cable Company, Inc.,** Bridgeport, Conn., and its products will be manufactured at the latter company's plant at Reading, Pa.

Elastic Stop Nut Corporation has moved its general office from Elizabeth, N. J., to its new plant at 2332 Vauxhall Road, Union, N. J., a suburb of Newark. This corporation's office at Houston, Tex., has been moved to the Merchants and Manufacturers building.

The Timber Engineering Company of New England has been formed, with office at 422 Border St., Boston, Mass. This

(Continued on page 468)

company, which is an affiliate of the Timber Engineering Company, Washington, D. C., has been organized to meet the demand in the New England area for information regarding the use of Teco connectors in timber construction.

The Koppers Coal Company, on June 1, moved its Philadelphia, Pa., district office from the Packard building to 1458 Broad Street Station building, and **The Wood Preserving Corporation** at that address has moved its office to the same suite. The Koppers Coal Company is an affiliate and The Wood Preserving Corporation is a subsidiary of the **Koppers Company.**

Personal

E. H. Anchors, branch manager for the **Air Reduction Sales Company** at Atlanta, Ga., has been appointed manager of the Oklahoma City, Okla., district.

Marshall Williams, assistant to the president of the **American Bridge Company,** Pittsburgh, Pa., a subsidiary of the United States Steel Corporation, has retired after 42 years service.

C. R. Hale, assistant purchasing agent since 1936 of the **Air Reduction Company, Inc.,** New York, has been appointed purchasing agent of the company and its subsidiary and affiliated concerns, succeeding **H. M. Daggett,** who has retired.

Pierre S. du Pont has retired as chairman of the board and **Lammot du Pont** has resigned as president of **E. I. du Pont de Nemours & Company,** Wilmington, Del. Lammot du Pont was elected chairman of the board and **Walter S. Carpenter, Jr.,** a vice-president, was elected president of the company.

D. J. Henecker has been appointed assistant manager of sales for wire rope, and **C. E. Kendall,** assistant manager of sales for wire and galvanized sheets for the **Jones & Laughlin Steel Corporation,** Pittsburgh, Pa. Mr. Henecker was formerly sales manager of the Wickwire Spencer Steel Company, for all its products in the eastern district, and Mr. Kendall has been with Jones & Laughlin wire sales department since February, 1939.

Dan Hiskey has been appointed to the research staff of the **Dearborn Chemical Company,** Chicago, specializing in pipe line coatings and wrappers. Mr. Hiskey is a graduate of the University of Southern California and for the last 10 years has been with the Southern California Gas Company. In his new position, Mr. Hiskey will engage in laboratory research on special problems and will also devote a good deal of time to the improvement of pipe coatings and wrapping application methods.

Edward R. Stettinius, Jr., resigned as chairman of the board of directors and as a member of the board of directors and finance committee of the **United States Steel Corporation** at a special meeting held on June 4. Mr. Stettinius presented his resignation in order to serve as a member of the recently appointed National Defense Commission. At that meeting **Irving S. Olds** was elected chairman of the board of directors to succeed Mr. Stettinius. Mr. Olds has been a director and a member of the finance committee of the Steel Corporation since October 27, 1936. He is a member of the law firm of White & Case.

Obituary

Brigadier-General **Otto H. Falk,** chairman of the board of the **Allis-Chalmers Manufacturing Company,** Milwaukee, Wis., died in that city on May 21 of a heart ailment. He was born in 1866 and after a grammar school training entered Allen Military Academy in Chicago, from which he was graduated as a captain. After many years of military experience, he retired in 1911 with the rank of brigadier-general. Gen. Falk was appointed receiver for the Allis-Chalmers Company in 1912, reorganized it as the Allis-Chalmers Manufacturing Company, and a year later was elected president. He became chairman of the board in 1932.

Trade Publications

Concretdense—The Flexrock Company, Philadelphia, Pa., has published a four-page folder describing the application and qualities of Concretdense, a material which may be used for hardening, waterproofing or patching concrete floors which are subjected to severe service and water or acid conditions.

Drainage Engineering—Young & Greenawalt, Chicago, has published a six-page folder describing the drainage engineering and contracting services offered by this concern. The folder is printed in color and illustrated with numerous photographs of corrugated pipe and various drainage installations.

Nordberg Utility Grinder—The Nordberg Manufacturing Company, Milwaukee, Wis., has published bulletin No. 95, which describes the Nordberg Utility Grinder, Type TG. The bulletin is illustrated with numerous photographs showing the grinder employed in various types of work and the various accessories available for use with it are listed.

Connectors in Highway Bridges—The Timber Engineering Company, Washington, D.C., has issued a 16-page illustrated bulletin devoted to the use of timber connectors in highway bridges. The bulletin is made up largely of detailed plans of 12 bridges of this type, the designs for which were submitted in a contest conducted by this company. One page of the bulletin is devoted to a discussion of the advantages of timber bridges with joint connectors.

Crosby Clip Book—"With An Eye to Safety," is the title of a new Crosby Clip book, which is listed as catalogue No. CCB-13, published by the American Hoist & Derrick Company, St. Paul, Minn., which describes the use of Crosby Clips in construction work, bridge work and overhead electrical transmission systems. The catalog also contains valuable data and safety rules on the use of wire rope and is attractively illustrated with numerous construction photographs.

Spray Painting Equipment—A 32-page handbook, The ABC of Spray Painting Equipment, has been published by the De-Vilbiss Company, Toledo, Ohio. The handbook presents its information in question and answer form and describes and explains the function of nearly every conceivable item of spray painting equipment. Additional clarity of subject matter is obtained with numerous drawings and diagrams.

General Purpose Hoist—The American Hoist & Derrick Company, St. Paul, Minn., has published a four page bulletin No. 100-H-O, describing the features and presenting the specifications of its new Model 20 General Purpose Hoist, which completes a line consisting of five models of general purpose hoists. The bulletin is attractively printed in color and illustrated with photographs.

Double Strength Steel—The Republic Steel Corporation, Cleveland, Ohio, has published a two-color, wire-bound, 40-page catalog on Republic Double Strength Steel, a high-tensile, low-alloy product. The catalog includes a description of the development and manufacture of this steel and of its physical and corrosion-resistant qualities. Many railroad and industrial applications are illustrated by photographs and its availability in various sizes, gages, finishes and special forms is discussed.

Transite Walls—A 20-page illustrated booklet devoted to a discussion of movable Transite walls has been issued by the Johns-Manville Sales Corporation, New York. The booklet tells how Transite may be used in the construction of movable walls for subdividing various types of interior space, and describes different decorative finishes that are available for such installations. Complete instructions are included for constructing walls of this type, which include a large number of detailed drawings.

Buda Products—The Buda Company, Chicago, has published bulletin No. 719-B, an eight-page bulletin printed in color, which illustrates and describes the complete line of railroad equipment and supplies manufactured by this company, including motor cars, push cars, trailers, wheels, crossing gates, car stops, switch stands, frogs, switches, bumpers, rail benders, drills, gages, levels, grinders, track liners, tie spacers, tie tampers, lifting jacks, Buda Hubron earth drills, and Diesel and gasoline engines.

Single-Stage Centrifugal Pumps—Fairbanks, Morse & Company, Chicago, has published bulletin 5810D, which describes the manufacture and construction features of its complete line of single-stage, split-case horizontal centrifugal pumps. Included in the bulletin are complete selection tables based on various centrifugal speeds, which simplify the problem of selecting the proper pump for a given output against a given head. Other tables of dimensions and general engineering information of interest to water service engineers are also included. The bulletin is attractively illustrated with numerous photographs, drawings and sectional views of pumps.

For A.R.E.A. Frogs Heavy-rail Classification

Bolted Rigid Frogs

Frog No.	Length	A.R.E.A. Plan No.	Quantity Normally Required 23"	27"	Reverse Hook	Total
4	9' 0"	271	8	4	..	12
5	10' 0"	272	10	2	4	16
6	11' 4½"	273	10	6	4	20
7	14' 7½"	274	12	8	4	24
8	15' 5"	275	12	8	4	24
9	16' 3"	276	16	6	4	26
10	17'10½"	277	16	6	4	26
11	18' 8½"	278	18	6	4	28
12	20' 4"	279	20	6	4	30
14	23' 7"	281	22	8	4	34
15	24' 4½"	282	26	6	4	36

Rail-bound Manganese-Steel Frogs

Frog No.	Length	A.R.E.A. Plan No.	Quantity Normally Required 23"	27"	Reverse Hook	Total
4	9' 0"	271	6	6	..	12
5	10' 0"	272	8	4	4	16
6	11' 4½"	273	6	10	4	20
7	14' 7½"	274	10	10	4	24
8	15' 5"	275	10	10	4	24
9	16' 3"	276	16	6	4	26
10	17'10½"	277	16	6	4	26
11	18' 8½"	278	16	8	4	28
12	20' 4"	279	18	8	4	30
14	23' 7"	281	20	10	4	34
15	24' 4½"	282	22	10	4	36
16	26' 0"	283	22	12	4	38
18	29' 3"	291	26	12	4	42
20	30'10½"	292	24	16	4	44

Solid Manganese-Steel Frog—Design 1

Frog No.	Length	A.R.E.A. Plan No.	Quantity Normally Required 23"	27"	Reverse Hook	Total
4	5' 8"	271	6	4	2	12
5	6' 5"	272	8	4	4	16
6	7' 4"	273	10	2	4	16
7	8' 1½"	274	10	2	4	16
8	8'11"	275	12	2	4	18
9	9' 9"	276	12	2	4	18
10	11' 4½"	277	16	2	4	22
11	12' 2½"	278	16	2	4	22
12	13' 0"	279	18	2	4	24

Solid Manganese-Steel Frog—Design 2

Frog No.	Length	A.R.E.A. Plan No.	Quantity Normally Required 23"	27"	31"	Reverse Hook	Total
4	5' 8"	271	6	2	2	2	12
5	6' 5"	272	6	6	..	4	16
6	7' 4"	273	6	6	..	4	16
7	8' 1½"	274	6	6	..	4	16
8	8'11"	275	8	6	..	4	18
9	9' 9"	276	10	4	..	4	18
10	11' 4½"	277	14	4	..	4	22
11	12' 2½"	278	12	6	..	4	22
12	13' 0"	279	14	6	..	4	24

Solid Manganese-Steel Self-Guarded Frog

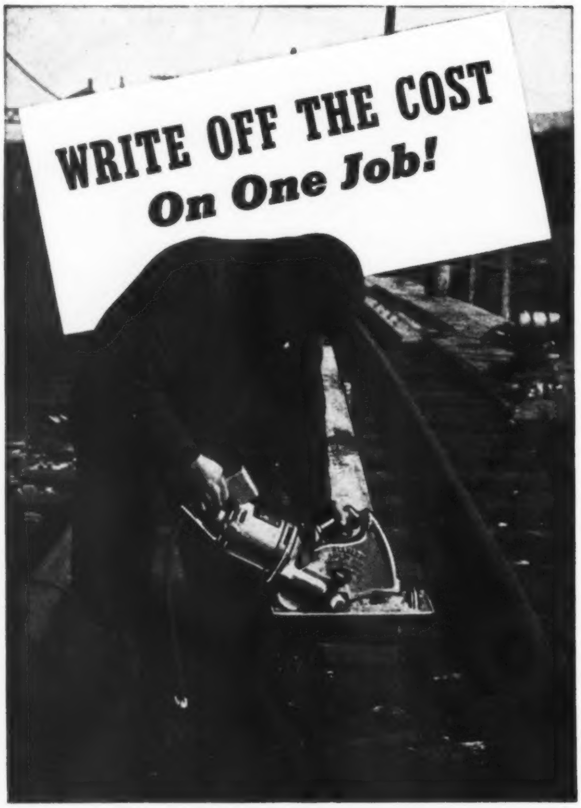
Frog No.	Length	A.R.E.A. Plan No.	Quantity Normally Required 23"	27"	31"	35"	Reverse Hook	Total
4	5' 8"	640	4	2	2	2	2	12
5	6' 5"	640	4	6	2	..	4	16
6	7' 4"	640	6	4	2	..	4	16
7	8' 1½"	640–643	8	4	..	..	4	16
8	8'11"	640–643	10	4	..	..	4	18
9	9' 9"	640	10	4	..	..	4	18
10	11' 4½"	640–643	12	4	2	..	4	22

5 SIZES OF FROG PLATES FIT 50 DIFFERENT FROGS

That, in a single sentence, is the lower-inventory story told by the tables at the left. Five standard Twin Hook Frog Plate sizes fit all 50 standard A.R.E.A. frogs. And, if five of the least used frogs are eliminated, three standard sizes fit the remaining 45 standard frogs.

Twin Hook Frog Plates are used in pairs. Hooks anchor the frog to the plates; spikes anchor plates to the tie. The forged hooks are larger and stronger than ordinary track-spike heads. The spikes, freed from any direct pull, do not loosen. Wear on the tie is minimized. Line and surface of the track are more easily maintained.

BETHLEHEM STEEL COMPANY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BLAST AWAY!

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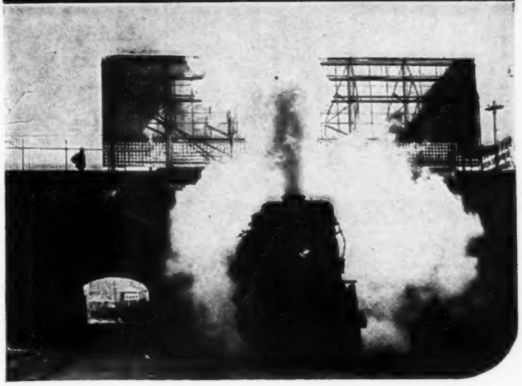

• Let fire box gases, blast fumes and severe cinder action do their worst after you've installed ARMCO Asbestos-Bonded Blast Plates. Your overhead structures are safe behind a *triple line* of protection.

First, these substantial low-cost plates are made of ARMCO Ingot Iron — proved by 34 years in corrosive service. Second, you have the added protection of a generous zinc coating. And finally, a thick special bituminous material is tightly bonded to the galvanized metal by ARMCO's exclusive Asbestos-Bonding process.

This unusual design provides great durability without excessive weight. Which is why ARMCO Plates are so much easier to handle than heavy, bulky types. Installation costs are low and the job is done quickly.

Make sure of long, trouble-free service by protecting your overhead structures with ARMCO Asbestos-Bonded Blast Plates. Write for prices and complete information. Armco Drainage Products Association, 505 Curtis Street, Middletown, Ohio.

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2—Short Tail Swing permits full circle rotation on thirteen-foot center tracks without interfering with traffic on adjoining tracks.

3—Handles Rails and all track metals with magnet: Coal, Cinders, Ditching, Excavating — with Clamshell.

4—Erects trestles, steel work: switches cars.

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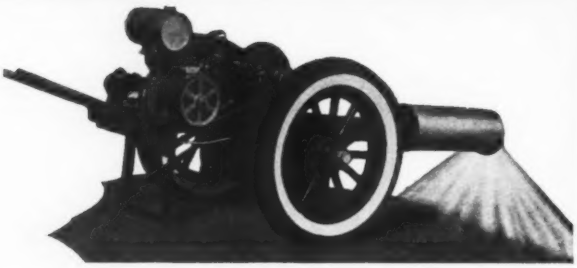

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ONE "JUNIOR" WEED BURNER on the above job would relieve all of these men for more productive work.

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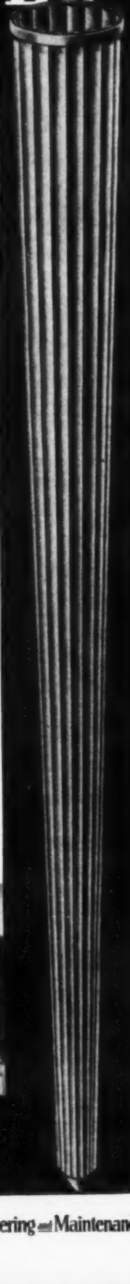

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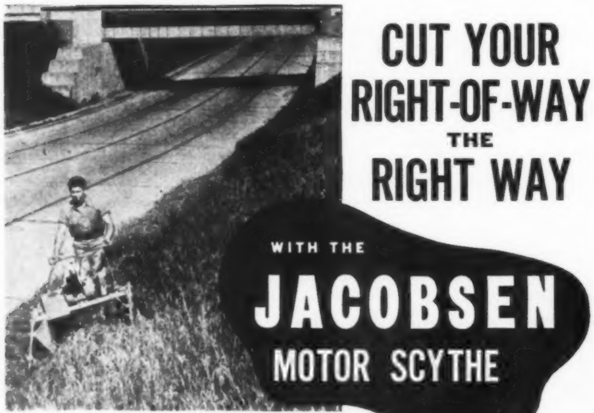

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